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AMERICAN ANTIQUITY

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ARCHAEOLOGICAL OBSERVATIONS ON THE PROBLEM OF POST-GLACIAL EXTINCTION

LOREN C. EISELEY

IN A recent paper notable for its lucid presentation of certain of the wider problems confronting the American anthropologist in his attempt to unravel New World prehistory, Dr. A. L. Kroeber has touched, doubtless with justified trepidation, upon the problem of Folsom man in America.[1] That subject has indeed suffered but little illumination in so far as its relation to the rest of the American archaeological record is concerned, and Dr. Kroeber, with sturdy honesty, minces no words in pointing out the hiatus which intervenes between this early horizon and later cultures. It is, he warns, dangerous to produce "speculative bridges that quickly tend to run into fantasy." He notes that "the earlier date, the longer time span, have an inherent attractiveness to most human minds." "So long," he says, "as there is a real possibility that some of the associations of human artifacts with extinct animals may be no more than three thousand years old, it is certainly not wise to build interpretations on the contrary possibility that some of them may be twenty-five thousand years old."

If these quotations, extracted from their context, suggest a certain acerbity of tone, let me be the first to point out that Dr. Kroeber has nowhere denied the possibility that the Folsom finds *may* be as old as the claims made for them. He merely urges, with good common sense, that where positive evidence is lacking "it is certainly wiser to keep estimates in suspense, or even to lean toward the smaller ones." Nevertheless, he does not hesitate to add that "evidence which has withstood searching critical inquiry . . . must be accepted."

It is in just this survey of existing evidence that the present writer finds some reason to differ with the opinions of Dr. Kroeber, and thus to intrude once more into this tantalizing and perennial field of controversy. In undertaking this paper, let me say at once that it is not my purpose to debate the antiquity of Folsom man, nor to quarrel with Dr. Kroeber's request for caution. Such comment as I shall offer will be merely an attempt to examine critically points which Dr. Kroeber could,

[1] Kroeber, 1940, See Bibliography, pp. 291–295, following.

perforce, touch upon only in passing. My justification lies in the fact that the chance comment of distinguished minds is all too likely to receive uncritical acceptance by the lay individual, and so pass on into the body of accepted knowledge without further question. Dr. Kroeber would, I am sure, label his views upon an unsolved problem as speculative. I shall attempt to consider this same material from a different point of view, desirous only that the reader be made aware of the possibility of alternative interpretation.

As a first step in our task, therefore, let us in turn examine certain of the difficulties involved in the evidence for Folsom antiquity as seen by Dr. Kroeber, bearing in mind that in expressing his views he is speaking for numerous colleagues who have voiced such arguments in the past. Limitations of space forbid an examination of all the points upon which Dr. Kroeber dwells. Some have been sufficiently examined elsewhere. Here we shall deal primarily with one point only: that bearing upon the extinction of the terminal Pleistocene fauna. Dr. Kroeber maintains that there is no reason to believe that around ten thousand years ago any sudden and decisive geological or climatic changes occurred which simultaneously wiped out a considerable number of animal species.

Instead, Dr. Kroeber implies a gradual extinction running on up into the Recent and (I can scarcely resist adding the word "conveniently") ends this slow extermination just before the period for which we have a clear archaeological picture. It is possible, he suggests, that some of these species were exterminated by man himself, perhaps very nearly at, or even into, the beginning of our consecutive archaeological record.

It will be well, perhaps, to consider these two points together. Neither is new. In fact this argument is logically, the final conservative retreat, now that the association of these forms with man has been sufficiently demonstrated. Admittedly it is a hypothesis well worth careful consideration. Involved in it, however, as often propounded, are certain questionable assumptions which, unless guarded against, almost imperceptibly vitiate its use as argument. In dwelling on one, at least, of these items, the writer hopes that he will have made plain what it is we shall have to establish before we can successfully claim the late survival of a relict fauna. The American data on extinction and survival were briefly reviewed by Schultz and the writer in 1935.[2] Since that time a little new information is available, none of which seems to clash greatly with the views expressed then. We have evidence of man's association with cold-loving forms farther to the south, it seems clear that *Bison taylori* survived into the period of ice retreat, as did also certain species of horse, camel, and elephant. No clear evidence, attested by carefully

[2] Schultz and Eiseley, 1935.

analyzed geological conditions or associated cultures, has yet established any survival of that fauna into the period of known cultures.

Dr. Kroeber, it would seem, is averse to any idea that the last glaciation might have been a formidable determining force toward extinction. At all events, he emphasizes the fact that around ten thousand years ago no decisive geological or climatic changes occurred which could conceivably have wiped out a considerable number of species. This is a rather surprising statement in view of our knowledge of European post-glacial events. There, where documentation from early post-glacial sites is much more complete, we find a rather sudden disappearance of a fauna adapted to cold conditions.[3] And that fauna, let it be emphasized, does not hesitate in its departure. It does not linger on in isolated valleys. Mammoth and woolly rhino have shot their bolt. They go.

It is quite true that at first glance it seems odd that a fauna which had survived the great ice movement should die at its close. But die it did. The reasons are difficult to give in exactitude. Perhaps many of these forms over thousands of years had become too well adapted to glacial conditions. Time may have proved too short for a readjustment to a warm climate. At all events they sickened and died. No doubt man contributed in a small, brief way to that final vanishing. But there is no evidence that he greatly altered events which were destined to transpire as they did without his interference. J. G. D. Clark indicates on his faunal records for the earliest mesolithic of northern Europe the final disappearance of the giant forms of the Pleistocene. And the datings here are attuned to highly perfected pollen analytical methods.[4]

That the course of events ran much differently in the New World may be doubted, so far as the major faunal trend is concerned. I know of no paleontologist who would dismiss the effects of glaciation upon the New World fauna with quite the same reckless abandon as Dr. Kroeber, even though recognizing the possibility of certain survivals. Dr. Romer, who has essayed to show the comparatively late survival of certain forms and hence is widely quoted by archaeologists, says of the closing period of the ice age:[5]

> That he [man] played any major part in actually killing off this fauna is far from probable, for in that case we should find much more evidence of his association with extinct types than exists at present

Now if it be granted that at least to a major degree the ice retreat and the changes accompanying it had an adverse effect on the American fauna, it becomes evident that the process of extinction must have begun before the ten thousand year date set by Dr. Kroeber. There must have

[3] Clark, 1936. [4] *Ibid.* [5] Romer, 1933.

been a falling off in numbers; perhaps an increased tendency toward communicable disease. What happens under wild conditions when a species dies? Does it go at once? Does it linger in remote areas? How long does it take for large gregarious animals to vanish? What paleontological data can aid us in our quest for certainty?

When the type site of the Folsom culture was reported to the world, those who found that it conflicted with previous ideas upon the subject of early man in America suffered discomfort. Inasmuch as the association itself could not be questioned, there were some who found relief in attributing the find to a case of phenomenally late survival in this particular locality, of a relict species of bison,[6] dismissing the whole incident as interesting but of no great significance. Unfortunately for this point of view, the years have established the association of this bison with man over a very wide expanse of territory, as well as shown, in many instances, a high percentage of other accompanying extinct forms. Be it noted, for reasons to be dwelt upon later, that *Bison bison* was not reported intermixed with *taylori* upon these sites.

The evidence which we possess upon the subject of extinction—and admittedly it is not great—suggests two types of disappearance: (1) A rather swift and total decline; where, even before the extinction point is reached, the population, for completely unknown reasons, seems to have descended below a minimum optimum for survival, and goes quickly. This seems particularly true in the case of the gregarious herbivores such as the mammoth. (2) A lingering survival in isolated areas often accompanied by scant numbers; the creature becomes a great rarity.

This second type seems to be somewhat more true of solitary animals. Often the animals are seen to be those which have not died out so much from climatic or other catastrophic events but through failure to survive in competition with intrusive forms which intensify the life struggle. The survival of the Galapagos land turtles and an almost certain late survival of the sloth in the West Indies are cases in point. Through simple isolation they escaped the dangers which destroyed them elsewhere. Parenthetically, it is worth pointing out that the rarity of an animal does not *necessarily* imply that it is becoming extinct. It may merely be a creature fitting some peculiar environmental niche which does not permit any great multiplication of numbers. Such cases, however, can generally be noted as instances of rare specialization.

Now if these two rough categories of types of extermination be kept in mind, it becomes very plain that we are approaching something of a dilemma. If we assume a wholesale and rapid extermination of fauna it seems impossible to attribute the phenomenon to the unaided efforts of

[6] The same argument found currency in connection with the earlier Florida problems. Here the presence of a water-bound peninsula served as persuasive argument.

man, and hence to divorce it completely from association with glacial changes. On the other hand, if we accept the alternative of lingering survival coming to an end purely, or mostly, by the hand of man at some late date, *we face the difficult prospect of explaining the presence of a widespread, non-local fauna so numerous that it was being exploited apparently to the exclusion of the living species of bison. And this in times so late that the following species should at least be present.*

Let us examine this problem with more care than is generally accorded it in the unqualified assertions of the conservative-minded. Let us take first the contention that man himself descended upon a widespread numerous fauna which had survived the ice age uninjured, and in a comparatively short period completely destroyed it. Perhaps the most direct, though not first, expression of this view is that given by J. G. D. Clark. He says:

> Some advance toward the solution of our problem might be made if the causes of the extinction of these creatures could be determined, but this unfortunately is far from the case. It is, however, worth remarking that while some animals are able to adapt themselves to surprisingly big changes in their natural environment, they are sometimes very susceptible to human activities. The influence of the games at Rome on the pluvial fauna of North Africa is here particularly relevant. The extinction of the wild bison on the High Plains of North America, where the advance of the railroad was preceded by a wave of unparalleled slaughter, is a yet more drastic instance. Within a space of fifteen years the "herds of enormous, incredible magnitude" . . . were reduced to about 500 head.[7]

Now if we leave aside for a moment some mild wonderment as to what Roman games and the near extermination of modern bison by the rifle may have to do with the problems of the primeval past, a question presents itself. Why, if we credit these early atlatl users with such deadly efficiency as to devastate a continent of its game, did the whites upon their intrusion discover that in spite of the fact that the historic plains tribes were using the even more deadly bow, bison, the living species, roamed the Plains in numbers almost astronomical in magnitude?

Bison taylori, the extinct species, so far as paleontology can tell us, was an animal whose habits were essentially the same. Yet according to this view, small hunting groups in the early days of an enormous empty continent exterminated their own game more successfully than any of the succeeding higher cultures. Not alone did they exterminate *taylori*, but in some mysterious way they permitted *Bison bison* at the same time to go unhunted and expand in numbers. Nor were they content to confine their exterminating activities to the bison. They destroyed mastodon, mammoth, horse, camel and a variety of other forms as well.

Yet to reiterate: man hunted bison with the bow in historic America; he hunted antelope; he hunted caribou. And all of these wild grazers,

[7] Clark, 1940, p. 128.

hunted by a population much in excess of that of the earlier periods of penetration, were flourishing until the arrival of the whites. Equally significant is the fact that native Africans hunting with iron weapons since time immemorial have made little impress on the swarming fauna of that great continent. Even the Roman games have probably had less influence on the North Africa fauna than the growing desiccation of that area in post-glacial time.[8]

We can only repeat that there is no solitary item of evidence which justifies the claim that man unaided by any other factor, caused the destruction of the terminal Pleistocene fauna.[9] Professor Froelich Rainey of the University of Alaska informs me that in certain regions of Alaska the bones of these extinct animals lie so thickly scattered that there can be no question of human handiwork involved. Though man was on the scene at the final perishing, his was not, then, the appetite nor the capacity for such giant slaughter. Further, though it is an obvious point, let us remember that such disappearances of a whole fauna, mysterious though they are, have taken place in periods prior to the intrusion of man upon the time scale.[10] In other words, mass extinction is not a phenomenon confined to the Quaternary nor solely explainable in human terms. The bones which lie in the dead lake beds of the Southwest are, as has been suggested, more indicative of desperate, drouth-harried faunal remnants seeking the moisture they could no longer secure.[11] In

[8] Leakey, 1936, p. 26; Hornell, 1941, p. 234; Antonius, 1938, pp. 7–8.

[9] Colbert 1940, p. 103: "Then at the end of the Ice Age when the last of the great continental glaciers was retreating to its present arctic limits there was a relatively sudden and widespread extinction of mammoths throughout the world . . . Was man concerned with their extinction? It seems hardly probable." [10] Thom, 1926, pp. 35–37.

[11] Earl Morris (1939, p. 11), makes the following suggestive comment: "As I see it, the process of climatic change and desiccation operative toward the very close of the Pleistocene brought about a concentration of the fauna in the most favorable localities. One of these stretched from north to south over the relatively high plains which parallel the eastern side of the Rockies, namely, that region in which the Folsom and related types of dart points appear to be most common. Conditions in such places would have been much like those existent today on the East African game ranges. Countless thousands of animals would have foraged upon the grasslands and congregated about the ponds and waterholes. Here were ideal hunting grounds and to them the scanty human population would inevitably have been drawn . . .

"The question arises, why have not remains comparably old been found nearer to the heart of the Pueblo area? It is not impossible that discoveries which will meet these requirements will be made as time goes on, but if not there need be no cause for surprise. Evidently the region, because of its relatively great elevation and tendency to aridity, would never have been a teeming game country and so would have offered little attraction to a purely hunting people. It was not until man had become possessed of the power to provide his own food supply that the mesa-canyon country became an alluring retreat. The line of descent, from the early hunters to the first agriculturalists will probably always remain obscure."

leaning to climatic changes involved in the ice retreat as the cause of extermination, the writer makes no attempt to assert that every single one of these species perished overnight. What he *is* at some pains to indicate is the fact that if this extermination is largely of the mass type, as it seems to be, it is difficult to dissociate it, even in its ending phase, from at least a moderately close relationship to that major climatic shift which apparently brought it about. All of our knowledge of the European faunal succession, a succession very similar to our own, suggests this as the most reasonable interpretation.

Our second possibility, that of lingering survival in reduced numbers, finally to face total extinction at human hands, must now be considered. Unquestionably, its appeal is great to those who would recognize the devastating effects upon fauna of the ice withdrawal and yet are dubious as to man's early intrusion here. This theory has the advantage of satisfying both points of view at once. In the first place, most of those who defend this point of view do not take the more extreme position that we have just analyzed and dismissed: that man, unaided by natural causes, exterminated the larger mammalian fauna of the Pleistocene during his first intrusion into the New World. Instead, they lean toward the second type of extermination: that is, the final destruction at the hands of primitive hunters of an already impoverished localized and dying fauna. Let us subject this view to analysis, first, by setting down certain facts which, given here somewhat dogmatically because of lack of space, nevertheless are fully supported by the literature to date.

1. We are not dealing with a single isolated relict species but a considerable variety of Pleistocene forms, all of which must be accorded, in the light of cultural evidence, an approximately similar time of extinction.

2. If these forms were coming to their natural end in the lingering way that has been suggested, we would expect to find only an occasional appearance, in kitchen debris largely representing the living fauna, of these lingering faunal relicts. Instead, taking the bison as a form most typically hunted by the Folsom people, and, furthermore, known to have been succeeded by a closely allied species, what do we find? An extensive, complete reliance upon an apparently widespread and numerous *Bison taylori* fauna showing no traces of rarity nor intermixture with the living form in any of the true Folsom sites which have been investigated to date.

The exact point of transition from the extinct to the living form and the possible degree of their overlap in time has never been clearly defined. Here and there *Bison bison* has been recovered from Peorian loess, but this loess is often difficult to distinguish from the young postglacial loess[12] and hence the lower time range of *Bison bison* is not very

[12] Lohman and Frye, 1940, pp. 846–847, also p. 854. Many others including Leighton confirm this view.

clear. Smith and the writer have recovered *Bison bison* remains from a reasonably old terrace in central Kansas with accompanying cultural remains[12] which lie above the Folsom horizon but which represent an antiquity measurable in terms possibly as high as five millenia. A considerable paleontological experience with the western deposits does not suggest that extinct faunal remains are "easy pickings" in the low terraces and recent alluviums of this area, as might be imagined if the animals concerned vanished just underneath our known horizons.

Nevertheless, it is not my wish to use this somewhat potent point dogmatically. The number of our sites is, as yet, inadequate and we need more intensive and careful application in the field to these faunal problems. We are not, for example, in a position to judge whether a seemingly greater sparsity of camel, horse and elephant remains is due to the fact that these animals were already growing few in numbers or whether hunting preferences were the point at issue. The main Folsom distribution, concentrated as it is in the High Plains region may, of course, be expected to show some preference for the bison as food.

Matters concerning cultural elements—problems also considered by Dr. Kroeber—are best taken up elsewhere. Here the sole conclusion worth emphasis is that this whole problem of post-glacial extinction cannot be clarified by simple dogmatic assertions. We need extensive investigations not alone of archaeological sites but of the successive faunas of the various datable terrace systems. In portions of the West, terraces extending from known Pleistocene horizons downward into the Recent are known, but only lately have they begun to be investigated.

Less romantic than the direct search for Folsom man, a consistent investigation of these terrace systems over wide areas might throw much light on the post-glacial attenuation and disappearance of the Pleistocene forms. It is a study that cannot be carried out without competent geological and paleontological assistance. Perhaps for this reason it is a neglected field. It would take much work and procure little in the way of exhibitable museum material.

It should be obvious after the work of Bryan and Ray, however, that terrace datings have become significant in this whole problem. Few, if any, archaeologists are genuinely competent to handle the technical details unaided, and as a result we may expect to find reference to the usual stock arguments while this new approach to the problem is skirted. I am not urging that the archaeologist abandon faith in his own techniques, but in claiming recency for such forms as the Elephantidae, for example, it would be unwise to ignore the fact that neither the Southwest of our time nor of the archaeologically established past could sup-

[12] Smith, H. T. U., 1938; Eiseley, 1939.

port them, and the extinct lake beds where their bones have been found associated with some phase of the Folsom culture have been reputably assigned to the moister period of the closing Pleistocene.[14] Surveying the enormous percentage of extinct forms recorded from these sites, it would seem difficult entirely to divorce this fauna and its disappearance from those climatic changes which accompanied the final withdrawal of the Wisconsin ice.[15] This is said in no dogmatic spirit, nor with any claim that all of these animals vanished at exactly the same point in time. If we are to date by a younger fauna, however, evidences for the existence of the younger fauna in numbers sufficient to suggest that the old fauna is completely relict must occur. To date, this is not evident and it tends to vitiate all exaggerated claims for recency.

In summary upon a problem which I have tried to present from a point of view somewhat different from that of Dr. Kroeber, I would indicate no quarrel with his regard for caution. I must confess, however, that I cannot vision *Bison bison* as a trivial mutation appearing casually on the scene some 2,000 years ago and multiplying quickly after the demise of an earlier fauna exterminated, so some would have it, by dextrous use of the spear thrower. I fail, in addition, to see how a dying, relict fauna could have constituted so large a proportion of the diet of early man that the later form of bison seems excluded from his sites. I further assert that a gap in our archaeological evidence will exist until we have evidence of such cross-sustenance.

But, by and large, as we penetrate back into this early time, as we extend our studies into the immediate region across which man must have passed in his first entrance to North America, we should touch upon a cultural stratum capable of demonstrable relationship to similar finds in Siberia. The tools, the utensils from both regions should be alike. And when that point is reached, geological datings on both sides of the straits will have to agree. If they do not, and if the cultural resemblances are too great to be explained away on the basis of pure coincidence, it will be apparent that an error exists in our estimates of man's antiquity either here or in paleolithic Siberia.

University of Kansas
Lawrence, Kansas
December, 1941

[14] Antevs, 1935, pp. 310–311.

[15] Schultz and Howard (1935, p. 293): "It is interesting to note that many of the cave forms now living in regions other than the Guadalupe Mountains are found to the north and in many cases in the higher mountains. Several of these species and varieties now live in life zones as high as the arctic Alpine Zone. This is a strong indication that the climate in the region of the cave, during the time of the Pre-Basket Maker occupation was much different than it is today."

THE STRATIGRAPHY OF VENTANA CAVE, ARIZONA[1]

EMIL W. HAURY

THE Papago Indian Reservation, touching the Mexican border in south-central Arizona, has been the scene of anthropological work by the Department of Anthropology of the University of Arizona and the Arizona State Museum during the past four years. One branch of this general study has been archaeological, consisting of reconnaissance and of excavation in what were considered to be key sites. Beyond Gila Pueblo's limited survey in Papagueria,[2] next to nothing was known about it. The environment is harsh and arid, and scanty surface water limits agricultural possibilities. Yet more than 5000 Papago Indians somehow manage, as they have for centuries, to make a comfortable if simple living in the area. Certainly the life there today is nothing new and it is a fair conclusion that, although inhospitable, the area should furnish a fairly rich archaeological picture. As our work proceeded it became evident that there were ruins in abundance. With few exceptions, these were small and the occupation thinly spread. Occasionally, a large site with sizable trash mounds gave promise of stratigraphy.

In 1939 and 1940, two sites were excavated and a skeleton chronology consisting of three phases, estimated to extend from about 800 to 1400 A.D., was proposed. Up to that time nothing had been seen which could be interpreted as older than 800 and there was no sure evidence which would permit us to unite this prehistoric sequence with the historic Papago. The first written accounts of these Indians date from the late 1600's, leaving a period of about 300 years, from 1400 to 1700, to be filled in.

Working under the assumption that villages visited by Father Kino in 1698 might have been old even at that time, a search was made to locate some mentioned in his chronicle. One of these, Batki, was found and arrangements to excavate were made with the Papago who claimed the area. But because the village had been destroyed in the mid-1800's by raiding Apaches, the Papago feared, on more sober thought, that our excavations would unleash the evil influences still hovering about the place as the result of that fateful raid. Hence, within an hour after the workers started digging, we were ordered to stop. In casting about for another village mentioned by Kino in the northwestern part of the reservation, the trail went near a large rock shelter, the existence of

[1] This paper appears before the Ventana remains have been completely analyzed. Statements should, therefore, be regarded as preliminary and subject to revision.

[2] Gladwin and Gladwin, 1929. See Bibliography, pp. 291–295, following.

which had been called to my attention several years previously by Mr. Alden W. Jones, a government employee at Sells. This shelter was visited and it appeared to be so promising that plans were shifted at once to include it in the program. On March 18, 1941, work was begun under the direction of Mr. Wilfrid C. Bailey, graduate student in Anthropology at the University of Arizona, and continued through May of that year. In April, 1942, the Arizona State Museum ended its second season in this shelter, Mr. Julian D. Hayden having been in charge of the field work.

Since this project is now concluded and the essential evidence collected, a preliminary statement concerning the significance of the site may be made. Few caves have been found in America with a culture-bearing deposit so deep, so rich, and so clearly stratified. Because the deepest human evidence represents man living under climatic and faunal conditions different from those of today, we have the excuse for including this paper in an issue of AMERICAN ANTIQUITY devoted to Early Man.

The Castle Mountains, a low and very rugged chain of volcanic hills, lie towards the northwestern margin of the Papago Reservation about seventy-five air-line miles west of Tucson and the same distance south of Phoenix. The shelter in question was located on the southeastern side of a detached hill, at the base of a basalt cliff and some 50 meters above the surrounding terrain. A few miles to the south, at the southern end of the chain, there is a natural window known as La Ventana, the name of which was appropriated to designate also the archaeological site, Ventana Cave.

The weathering of a soft volcanic agglomerate from beneath a more resistant basaltic flow has formed a protected area some fifty meters long, the axis trending more or less parallel to the cliff face. The southeastern end was more deeply hollowed out, penetrating the volcanic mass for about thirteen meters. Here the shelter more nearly approaches true cave conditions, in contrast to the outer and less protected section. At the innermost end there is a seep spring, fed by water falling on the narrow ridge which forms the hill, then filtering down through the shattered volcanic rocks to come out at the agglomerate-basalt joint. This spring has long been used by the Papago, and, obviously, also by the inhabitants of the cave throughout its history. The output from this spring at some remote time was much larger than today, as attested by run-off channels worn in the deeper cemented deposits of the cave. Now there is no surface run-off whatever from this water source and the underground seepage extends only some fourteen meters from the source.

A short distance beyond the southwestern end of the cave the basaltic cliff is gashed by water cascading off of a limited part of the higher surface of the hill. At the base of this miniature canyon, a talus cone has developed. Water from this talus once penetrated the cave in flood proportions, carrying with it rocks, gravel and silt which added considerably to the bulk of the cave fill. As will be seen presently, this event took place long ago, since more recently the talus has become nearly stabilized and its effect now is negligible.

A rock partition at about the middle of the inhabited area divides it into what we have termed the upper and the lower parts of the cave. This partition effectively prevented the water from reaching the lower portion, and also was partly instrumental in retaining the water draining into the upper cave in early times to help form the deepest layers. As a consequence, the upper part evidenced the most significant stratigraphy and the discussion will be confined to that area. These physical features, hastily sketched, must be taken into consideration in trying to understand the history of the cave.

A broad outline of the succession of events can best be followed with the aid of a profile (Fig. 15). The initial scouring of the cave was caused primarily by water coming from the spring and by water from the outside draining down the cliffward fringe of the then small talus cone. These waters combined with enough force and over a long enough period of time to erode a channel in the bedrock floor 100 cm deep at the point where the water spilled out of the cave. Eventually, the foot of the growing talus reached this outlet, and evidently aided by a rock-fall, the outlet was blocked, causing the water to pond against the partition at the lower or northeastern edge of the upper cave. Under these pond conditions the conglomerate deposit was formed. The pool drew animals and the bones of some which died or were killed on the spot became a part of the bed. The identification of these, by Dr. E. H. Colbert of the American Museum of Natural History, based on specimens collected during the first season, include a few existing species and an extinct form of horse, bison, giant ground sloth and tapir. The direct evidence of considerable water in the cave and the type of forms represented argues for a higher precipitation at some stage in the past than the region has today (average annual rainfall about seven inches).

After the drying of the pool, possibly caused by a break in the barrier, the surface of the conglomerate underwent some change, perhaps by trampling of feet and by slight erosion. On it there developed a layer of light grey volcanic debris, cemented with lime, of which a maximum depth of less than 50 cm remains. Dr. Kirk Bryan, on seeing this deposit in January, 1942, felt no hesitation in assigning it, along with the

conglomerate, to a wet cycle. The lower zone of the cemented debris was quite homogeneous, while the upper part was irregularly bedded from periodic flooding. Between the beds there were thin layers of wind blown material. Although the genesis of this layer must be attributed basically to water, increasing aridity appears to be indicated. Throughout the layer there were bones, highly fractured, of the animals previously mentioned as present in the conglomeratic layer. Charcoal and the stone implements of an early hunting people, were also found all securely cemented in the matrix.

Subsequent to its deposition, this volcanic debris was subjected to extensive erosion and an unknown amount was washed away, leaving the surface irregularly planed. It is clear that this disconformity represents an interval of time of considerable extent because in the interim some of the animals became extinct and the culture type changed. These changes are reflected in the layer of indurated sand immediately above, which produced the remains of only modern animals together with other types of projectile points and tools.

The origin of the hard sand may be attributed to combined wind and slow water action, the water still draining in from the talus cone. After its deposition, considerable erosion took place, washing it completely away in some parts of the cave. Then followed a period when the talus slope was developing rapidly. Its fringe encroached the cave, bringing in a jumble of large and small rocks which were never cemented. Man was also making increased use of the shelter at this time, as attested by an ever increasing amount of implements, greater concentrations of ash, and many bones of modern food animals.

Up to this point in the stratigraphy, natural forces were primarily responsible for moving materials from the outside into the cave; after this point, the deposit assumes pure midden character for which man was primarily responsible.

The midden at its deepest point measured approximately four meters, although the average was somewhat less. In the lower two-thirds, all organic materials had been destroyed by moisture derived from the seepage from the spring and some run-off from the talus; but the upper third of the midden was dry, and therefore contained the perishable goods of the people who were responsible for the trash. Neither spring water nor talus run-off were sufficient to affect this layer.

The chief interest for this paper focuses on the layer of volcanic debris with its tools and associated extinct fauna. Its relative chronologic and cultural position can best be brought out by rapidly sketching the overlying material from top to bottom. The surface debris, a thin veneer, was made up largely of historic Papago remains, including some

pottery, wood, metal, glass, and textiles. Throughout the dry layer and included also in the very upper part of the moist layer, was pottery and evidence of agriculture (corn). The pottery includes all the major types described from Snaketown,[3] along with some others. For the most part, the people who inhabited Ventana Cave during this time appear to have been Papaguerían cousins of the Hohokam, deviating from the parent group in certain respects. The most intense use of the place seems to have been made from about 1200 to 1400 A.D. Most of the thirty-eight burials found in the dry layer probably belong to this time. It is worth noting that the arrival of pottery, and doubtless agriculture also, was not accompanied by a general break in the continuity of the culture pattern. These traits appear simply to have been added to the complex. When this took place may be subject to debate, but a guess of from 1500 to 2000 years ago may be made.

The moist zone of the midden, much greater in volume than the dry layer, was richly filled with the chipped and grinding implements of a pre-pottery people. The most that can be said about this before the analysis has been completed, is that the implements from the upper part of the moist layer correlate well with the San Pedro Stage of Sayle's Cochise culture;[4] towards the lower parts of the deposits, the analogies are with the Chiricahua stage. The characteristic abundance of grinding tools connected with the preparation of gathered foods is a trait which the Ventana trash shares with the Cochise. The abundance of projectile points, of which well over 2000 have been collected, is in marked contrast to the Cochise culture. A high proportion of these resemble the points reported from the Mohâve and Pinto Basins of California.[5] Although a detailed comparison has not been made, it is safe to say that almost without exception the tool assemblages from California are duplicated in Ventana. It is worth noting also that they occur here with modern fauna.

The wedge of talus material was not completely sterile, indicating that man frequented the place during the accumulation of that layer. As the implements are not appreciably different from those from the lower part of the midden, no cultural break need be inferred.

Some lapse of time between the accumulation of the talus material and the deposition of the underlying sand is indicated by the physical character of the layers and by the implement types, although the fauna remains unchanged, i.e., modern. A rather consistent projectile point type from the sand is illustrated by outline in Fig. 15, right hand col-

[3] Gladwin, Haury, Sayles, and Gladwin, 1937. [4] Sayles and Antevs, 1941.

[5] Campbell and Campbell, 1935; Campbell, Campbell, Antevs, Amsden, Barbieri, and Bode, 1937; Rogers, 1939.

umn, second from the bottom.[6] It resembles the Pinto Basin point of California, but is not identical with it.

This brings us now to the cemented layer of volcanic debris with the oldest implements. Again a disconformity between the hard sand and this layer needs to be noted, as a considerable element of time appears to be involved. Between the episodes which caused the deposition of these two beds, the horse, bison, sloth and tapir became extinct and there was also a change in culture type.

The tools from the cemented layer, approximately ninety in number, include some types which occur also in higher levels, but the typology is not nearly as rich. The collection consists of a variety of scrapers, several gravers, two projectile points, choppers, and one grinding tool. The complex, as a whole, matches very well the Folsom complex as described for the Lindenmeier site,[7] although the implements are less well made because of the limitations imposed by the poor quality of the material, basalt, from which they were made. One of the two projectile points is a small quartz leaf-shaped blade and the other, made of basalt, is shaped like a Folsom point but lacks the fluting. The maker of this point seems to have been aware of the fact, however, that basalt could not be channel flaked. As a consequence he started with a thin flake, obtained the desired form without modifying the original flake scars which, though flat, simulate the fluting normally seen.

The Folsom culture has not previously been identified in Southern Arizona and the evidence from Ventana Cave may seem too inconclusive to warrant such correlation at this time. But it can be pointed out that this oldest Ventana culture was in existence at a time when the climatic and faunal conditions were much the same as those experienced by the Folsom culture, and that the implement typology is nearer Folsom than any other early culture known at present. Finally, a measure of relative antiquity is also supplied by the overlying mass of cultural evidence.

University of Arizona
Tucson, Arizona
July, 1942

[6] This arrangement of projectile points is intended to indicate trend only. They were not so neatly bracketed as shown, especially in the midden.

[7] Roberts, 1935; 1936.

THE FINLEY SITE

Discovery of Yuma Points, in situ, near Eden, Wyoming[1]

Edgar B. Howard

A PRELIMINARY report has already been made on the Finley site,[2] located in Sweetwater County, southwestern Wyoming, in the southeast corner of the N.E. ¼ of Section 25, Township 24 N., Range 106 W., about four and a half miles east and a little south of the town of Eden, which itself is approximately thirty-seven miles northwest of Rock Springs. The altitude of the site is approximately 6750 feet.

The site was laid out in 100-meter sections, which were subdivided into 1-meter squares. In 1941, excavation was carried on principally in section M (see Fig. 16), although some work was done in adjoining sections, and test pits and auger holes were dug at many places surrounding the main excavation as may be seen in Fig. 18. The axes A–B, and C–D were laid out in 1940, point A being approximately 153.4 feet from stake #8, point B approximately 97.5 feet and points C and D approximately 75.8 feet from stake #8. This stake was used as the zero elevation in 1940; the top of it was 4.63 feet above the zero contour as shown on the map made by Mr. Finley in that year (approximately 1.40 meters as used by Mr. Satterthwaite). It was more convenient in 1941 to use the top of stake #2 for a datum. This measured .37 meters above top of stake #8.

After a few days spent in studying the site and the surrounding region we began excavation in 1941 where Satterthwaite and Bache had left off the previous summer. The artifacts recovered from the site were all either spear points or knives, although from nearby surface localities

[1] Preliminary work was carried on in 1940 for the University Museum of Philadelphia, at a buried Yuma site, near Eden, Wyoming, under the direction of Mr. Linton Satterthwaite. This work was continued in the summer of 1941 sponsored jointly by the University Museum and the Nebraska State Museum. The party in 1941 included Frank J. Dudek, and L. Robert Wolfe from the latter institution, and Dr. John T. Hack, Robert P. Howard and Edgar B. Howard representing the University Museum. Dr. Hack, of Hofstra College, carried on the geological work, the results of which appear in the following part of this report. F. J. Dudek and R. P. Howard assisted Dr. Hack in the topographic work from time to time. Mr. O. M. Finley, formerly of Eden, Wyoming, who discovered the site, and through Mr. Harold J. Cook of Agate, Nebraska, brought it to our attention, spent as much time with us as he could, without interfering with his Government duties. We wish to take this opportunity to thank him for what he did to help us in so many ways. We also wish to thank Dr. W. H. Bradley, of the U. S. Geological Survey, for his interest and suggestions when he visited the site.

[2] Howard, Satterthwaite and Bache, 1941. See Bibliography, pp. 291–295, following.

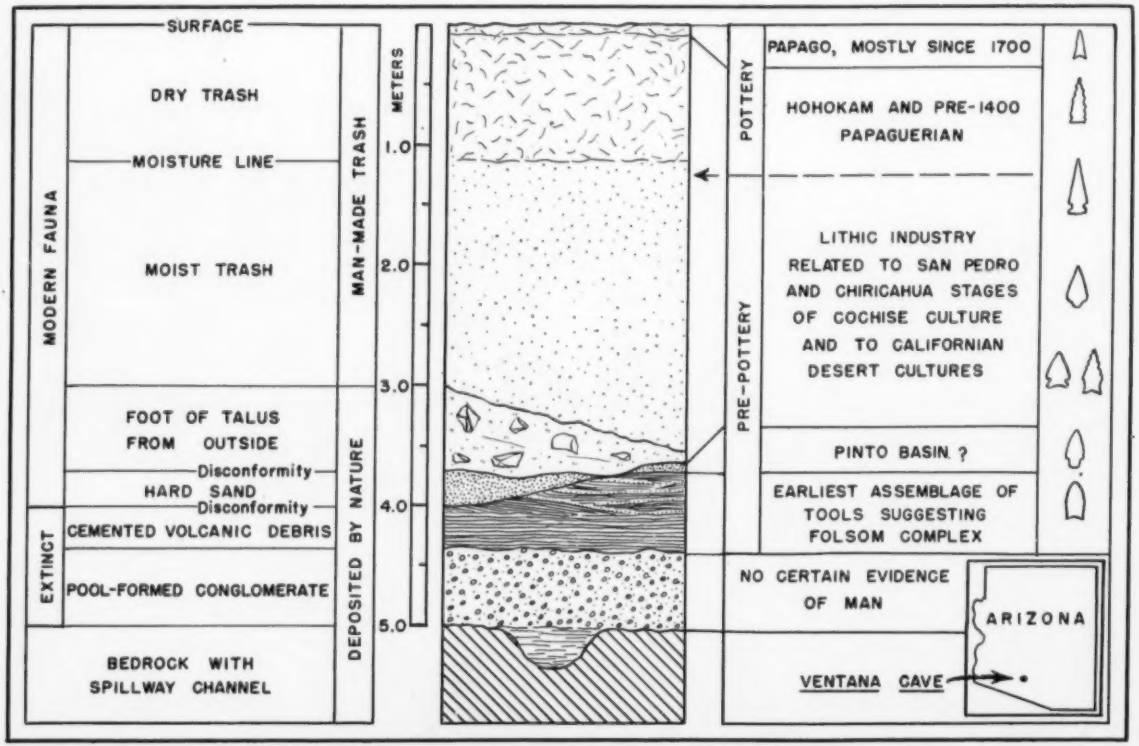


FIG. 15.—Stratigraphic column of Ventana Cave, Papago Indian Reservation, Arizona, with explanatory data: *left*, physical, and *right*, cultural characteristics.

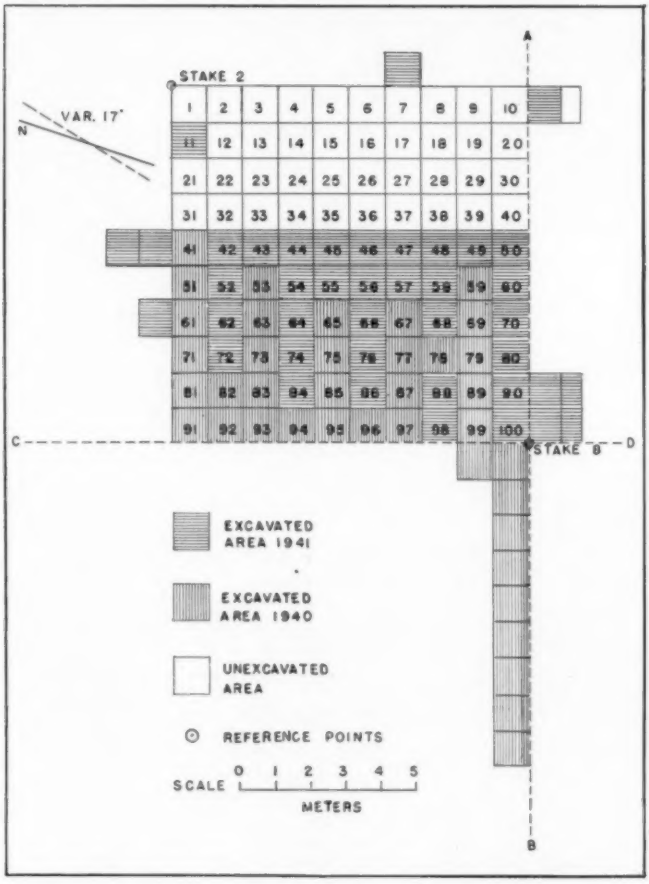


FIG. 16—Excavation of Section M and adjoining test pits, Finley site.

came a few scrapers in addition to other types of points and knives. A complete list of projectile points and knives found at the Finley site in place is given in Table 1, nos. 21–28 were found in 1941, the remainder in 1940.

TABLE 1

POINTS FROM THE FINLEY SITE*

Field No.	Catalogue No.	I Blade length	II Max. width of blade	III Max. thickness	Total length	Base length	% II–I	% III–I	% III–II	Location Figure 1
1	Finley	47	32	5	—	b.b.	68	10	16	L-80
2	Cook	50	35	6	—	—	70	12	17	M-81
3	Finley	40	18	7	—	—	—	—	—	M-93
4	Cook	68	20	7	81	13	30	10	35	V-5
5	Finley	62	22	7	72	10	35	11	32	V-17
14	40-36-4	69	23	5	—	b.b.	33	7	22	M-77
15	40-36-1	91	15	7	103	12	16	8	47	M-77
16	40-36-3	39(1)	20	6	—	12	—	—	30	M-65
17	40-36-5	69	23	8	82	13	33	12	35	M-78
18	40-36-6	74	28	9	—	b.b.	38	12	32	Test pit #4 (2)
19	40-36-2	90	18	7	103	13	20	8	39	(2)
21	41-26-1	69	24	8	81	12	35	12	33	M-72
22	41-26-2	64 (68E)	26	5	70 (74E)	10	(38E)	7	20	M-62
23	41-26-3	40 (53E)	32	5	—	b.b.	(60E)	9	16	M-88
24	41-26-4	61	22	8	—	b.b.	36	13	36	M-52
25	41-26-5	64(1)	17	7	—	b.b.	—	—	—	M-67
28	41-26-8	50	24	6	—	b.b.	48	12	25	M-44

* Measurements in millimeters. b.b. =base broken. (1) =to break.
(2) =incrusted with same material as others; but not actually found in place. E =estimated.

In the preliminary report we stated that most of the above artifacts were made of mineralized wood. This occurs in the region, but in discussing the matter with Mr. Roy G. Coffin of Fort Collins, Colorado, who has made extensive studies of this region, I am convinced that he is correct in saying that most of these artifacts were made from a flint-like material in which the silica formed around algae. Good sized concretions of this occur in the region north and west of the Finley site, and when the weathered surfaces are removed, a fine homogeneous bluish-black, or dark brown material remains, which must have proved excellent for the use to which it was put. In cross-section the above projectile points and knives vary from an almost completely diamond shape, as in the case of nos. 15 and 18, through ellipses to quite flat sections, as in the wider specimens.

All of the artifacts found in place at the Finley site were in the buff sand and clay deposit (Figs. 18 and 21). One was recovered from the

sieving, but it is quite certain that it came from this same sandy clay, as the recent dune sand above it had been removed previously, and the sandy clay was kept separate as each section was excavated. In this same sandy clay most of the bison bones were discovered. A few of these bones occurred at the very bottom of the dune sand, and also a few in the top of the more indurated sand, just below the clay; and the latter were somewhat mineralized when compared to the others a little higher up, which were only decalcified. As stated in the preliminary report of this site, the greater proportion of the bones were foot bones, although a good many bison teeth were found. Here and there fragmentary material from all parts of the skeleton occurred. Also, as reported previously, a great many of the metapodial bones were split or broken just above the distal ends. It is hoped that a more detailed report upon the bison material will be published later by Dr. C. B. Schultz, who, together with his wife, spent a day or two at the site with us, and has kindly undertaken to study the bison bones found there in 1940 and 1941.

Test pits were dug in all directions around the main excavation, and auger holes were drilled over a very much larger area, for the purpose of checking the extent and levels of the sandy clay and underlying green sands, and to find if possible, the distribution of the bone deposit. The outlines of this distribution, and the possible extent of the clay at the site is shown in Fig. 18. It is quite likely, however, that other concentrations of bone and patches of the sandy clay occur farther up the slope of the sand dune to the east and southeast. That this buff sand and clay occurs irregularly over a considerable area is plain (Fig. 20).

In addition to the artifacts found at the site proper, a number of artifacts were found at nearby locations, particularly by Mr. Finley in 1940, and, from indications, at least some of them appear to have weathered out of a sandy clay level similar to that at the site. One such locality is about 500 feet north and slightly east of stake #8, where Mr. Finley found part of a "fluted" point. We dug a number of test pits here and near the springs, where the Washington Ranch house had once stood. However, we found no artifacts nor bison bones in place at these localities, nor at sand blow-outs at other places along the dunes, north and northeast of the main excavation. Dr. Hack found a fluted point on the surface near the Washington Springs, but we shall not concern ourselves with artifacts found on the surface, in blow-outs, on gravel terraces, or in the sand dunes of the region. A study of them which represents a considerable undertaking in itself, would require more space than we have at our disposal. In passing however, we may point out that many of the hand choppers, and heavy scrapers found along the gravel terraces are quite similar to some of those described by Renaud from the Black's Fork Valley.

Folsom-Yuma Classification

Before attempting to classify the Yuma points found at the Finley site it would be well to examine the present status of the so-called Folsom and Yuma problem. There has been a good deal of confusion as to what constitutes a Folsom and a Yuma point. For the purpose of trying to clarify this situation, the University Museum of Philadelphia, together with the Laboratory of Anthropology, called a conference in Santa Fe in September, 1941, and certain suggestions were agreed upon.

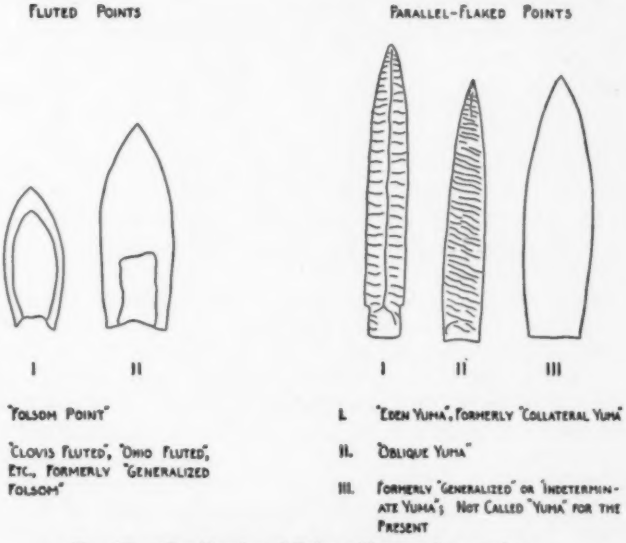


FIG. 17.—Classification of Folsom-Yuma points used at Santa Fe Symposium, 1941.

As a starting point, it was decided to accept the suggestion made by Shetrone in the Ohio State Archaeological and Historical Quarterly for July, 1936, and call all points that had a fluting or channel on one or more faces "fluted" points. Then it was agreed that, under this general term, any point showing the characteristics of the typical Folsom, originally found at Folsom, New Mexico, should be referred to as a Folsom point (Fig. 17) thus eliminating from this category the types which were being called "Folsom-like," or "generalized Folsoms," and placing them instead in the "fluted" point group, with appropriate names added to differentiate them from each other, as "Ohio fluted," or "Clovis fluted," etc. For what we were calling Yuma points, we agreed

provisionally to use the term "parallel-flaked" points, substituting under this general heading "Eden Yuma" for "collateral Yuma," retaining the use of the name "oblique Yuma," for the time being, for the type with the fine oblique flaking on the faces, and dropping altogether the use of the names "indeterminate" or "generalized Yuma" until we know more about where they actually belong in such a classification.

Folsom Type. Let us examine this whole problem a little more closely, and let us start with the type site of Folsom itself. Before doing this, however, we must relate an interesting occurrence which has some bearing upon the question. In the original collection from Folsom, made by the Colorado Museum of Natural History, there was the tip of a quartzite point. Six or seven years after the completion of the work at Folsom, in 1934 to be exact, the writer picked up the base of a Folsom point, made of quartzite, on the dump that had been left at the site. To make a long story short, the two pieces were recently brought together at the University Museum in Philadelphia, with the result that there is no doubt whatever that they are one and the same specimen (Pl. VIII, *c*). This furnishes three practically complete points from this site, instead of the two already known. This is the only quartzite point from this site. It has the fluting on only one face, and it was probably broken at the time it was last used. There is some difference in the weathering of the two pieces, indicating that they had been separated for a long time. Thanks are due to the Colorado Museum of Natural History for allowing the University Museum to retain this specimen. Pl. VIII, *a* and *c*, are two of the restored points from Folsom, the third is still in the matrix in the collections of the Colorado Museum of Natural History. Other specimens from the site were broken, in spite of which it is possible to see that there are variations in form. The point shown in Pl. VIII, *a* is widest towards the tip, just above a line drawn through the middle of the specimen (using the overall length). The one in the matrix (not shown here) is widest at approximately the same place, while Pl. VIII, *c*, is widest from the middle to just above the base. From the broken specimen in the center of the top row, and others like it, one cannot secure complete measurements, but it is obvious that it is a more pointed variety than the ones we have been considering, and almost certainly it was wider below the middle. The longest specimen of typical Folsom point so far measured is 90 mm long. The specimen in Pl. VIII, *g*, measures 80 mm long to the break. Even if we add 20 mm to this to complete it, and this would be 10 mm longer than the longest one measured, the widest part would be below the middle. We have three variations, then of the Folsom (typical Folsom), depending on whether the greatest width is (1) above (Pl. VIII, *a*) or (2) below the

middle (Pl. VIII, *b*), or (3) whether the point is approximately the same width from above the middle to the base (Pl. VIII, *c*). This gives us in outline one variety with convex sides, rounded towards the tip; one with more pointed tip; and one with sides straight from near the base to within about one-third the distance from tip to base. Other straight-sided ones are shown in Pl. VIII, *g* and *h*, one from Lindenmeier and one from Clovis. We have come to think of the specimen in Pl. VIII, *a*, as being typical and it would serve no good purpose to try to change this view; but it is well to observe that there are several of the other varieties in the collection from Folsom, although most of them are broken specimens.

TABLE 2

COMPARISON OF FOLSOM POINTS*

	Folsom N.M.			Renaud	Roberts (Lindenmeier)		Howard (Clovis)	Hibben (Sandia)	
	#1	#3	Col. Mus.	Range	Broad blade	Short blade	Range	a	b
Length (overall)	58	63	47	17–75	22.5–90	23.5–90	27–83	40	38
Max. width	24	23	21	14–33	14–37	13–30	15–26	21	20
Max. thickness	3	4	4	3–6	3.5–6	2–4	3.5–6	3.5	3
Ratio of fluting to length along center	84%	82	79	—	—	—	66–90	77	76
Flakes per cm. along edges	7–8	6	6	2.25–7.5	—	—	6–7	5–7	6–7
Ratio width to length	41%	37	45	—	—	—	28–74	52	53

* Measurements in millimeters.

The base of the Folsom point is concave, the cross-section of the blade usually bi-concave, although occasionally the fluting occurs on only one face, as in the specimens in Pl. VIII, *c* and *h*. Smoothing along the edges near the base is usual, but exceptions are noted. Materials include jasper, chalcedony, moss-agate, chert, flint, and, more rarely, petrified wood and quartzite.

The principal sites where Folsom points like those shown in Pl. VIII have been found in place are: the type site of Folsom, New Mexico; various sites near Clovis, New Mexico; and the Lindenmeier site in Colorado. There are also the Johnson site in Colorado, about twelve miles southwest of Lindenmeier, and the Lipscomb County, Texas, site. Complete information about the latter site is to be published shortly, but Dr. C. B. Schultz writes that the pieces are typical Folsom. A number of Folsom points have been found on the surface in various places: New Mexico, Colorado, Oklahoma, Texas, Kansas, Nebraska, Wyoming, to name those that come to mind. Nearly all these surface sites are

in the Great Plains Province. One exception from Wisconsin which Mr. Byers brought to my attention early in 1941 could certainly be classed as a typical Folsom point.[3]

Clovis fluted point. The great variety of points which formerly went under the name of "Folsom-like" or "generalized," both of which terms have been dropped since the Santa Fe meeting, belong in this second group. A few have been found in place well below the surface, mostly on or near the High Plains. A large number have also been found on the surface, and with a wide distribution. The former, to which we are giving the name of "Clovis fluted" (Pl. IX) at least for the present, is very much like certain specimens found on the surface, but it occurs in association with the mammoth, and in some cases with other extinct forms.

TABLE 3

COMPARISON OF CLOVIS FLUTED POINTS*

	Clovis		Dent, Colo.		Miami, Tex.		Abilene, Texas	Burnet Cave, N. M.	Range
	#1	#2	#1	#2	#1	#2			
Length	109	83	115	95	76	116	90	52	52–116
Max. width	26	25	31	37	25	30	24	23	23–37
Max. thickness	8	—	—	—	7	9	—	8	7–9
% of fluting	50	66	25	40	66	—	44	60	25–66
Flakes per cm.	2–3	3	2–3	2–3	2–3	—	2–3	2	2–3
Ratio of width to length	24%	30%	27%	39%	33%	26%	28%	44%	24–39%

* Measurements in millimeters.

The base of the Clovis fluted point is slightly to deeply concave, and the cross-section of the type is irregularly bi-concave. There is some variation in length and width, and there are measurements which overlap the Folsom. On the whole, however, they are longer than the Folsom, and when taken with other characteristics, it is possible to differentiate them from this type. The distribution of these points, found in situ is: Burnet Cave, New Mexico; Clovis, New Mexico; Dent, Colorado; Miami, Texas; and Mulberry Creek, near Abilene, Texas. The materials are mostly flint, chert, chalcedony, and quartzite. The faunal association is with the mammoth in each case, except in Burnet Cave, where the remains of this animal were not found, but other extinct forms were in association.

Ohio fluted point. The next type we must consider is the surface type of fluted point (Fig. 17 and Pl. X) which has a wide distribution, covering practically the entire country, and parts of Canada. The fluted points from Borax Lake would be included here with this group. Though specimens have turned up in so many parts of the country, they seem

[3] Byers, 1942.

to have a concentration in the Ohio drainage area, and in the general region of Illinois, Indiana, Ohio, Kentucky, Tennessee, and Missouri. This concentration does not seem to be altogether explainable by the intensive archaeological work that has been carried on in the Mound region. The suggested name of "Ohio fluted" point for these surface types seems to be appropriate, and should take the place of "Folsom-like" or "generalized Folsom." At some later time, it should be possible to break this large group up into sub-groups. In shape, these points range from those with straight sides to those with decidedly convex sides. Further differentiation can be made on the position of the greatest width: those in which the greatest width is approximately at a middle line of the face, and those in which it is below this point, with further variation in which the edge flares into a sor[illegible]ish-tail" just above the base.

TABLE 4

SIZE RANGE OF OHIO FLUTED POINTS

	Range in mm.
Length	34–159
Max. width	15–43
Max. thickness	4–10
% of fluting	24–82
Flakes along edges	3–6
Ratio of width to length	19–55%

Compared with the Folsom we see that this type, which covers a considerable range in shape and size, is relatively longer, proportionately wider, twice as thick, with fluting about half as long, and with approximately half the number of flakes along the edges. Pl. X, illustrates a few of these. Furthermore, the distribution of the Folsom point is more restricted than that of the Ohio fluted point. Also, in passing, the Eskimo slate points which have a fluting ground into the faces, must be mentioned, although they have no relation to the points we have been discussing. What we have given here is not intended as a complete description of the fluted point, but as a supplement to the various detailed descriptions.[4]

Parallel flaked point. The name of the "parallel-flaked" point (Fig. 17) was suggested at the Santa Fe meeting. It can very likely be improved upon, but it will serve its purpose for the time-being. In a classification of Yuma points, proposed by Miss Wormington and Miss Holmes, and based largely upon study of the Anderson collection from Yuma, Colorado,[5] three main types were suggested: "oblique," "col-

[4] Figgins, 1934; Renaud, 1934; Roberts, 1935; Howard, 1935; and Wormington, 1939. [5] Wormington, 1939.

lateral" and "indeterminate." Of 500 specimens examined the three types were fairly evenly represented in the collection. Of the oblique type 85% had concave bases, and no stems, while 85% of the collateral type had straight bases and 40% were stemmed. These artifacts from Yuma were weathered out of surfaces from which the overlying sands had been removed by the wind. Similar sites occur in western Oklahoma, and the adjoining counties of the Texas Panhandle, as well as in the blow-outs between Clovis and Portales, New Mexico, and other parts of Colorado.

Eden and Scottsbluff Yuma. Among the artifacts found at the Finley site, is the type heretofore called "collateral Yuma." It was suggested at the Santa Fe meeting that this type now be named "Eden Yuma." This would seem to be appropriate within certain limits. However, in order to be consistent with the plan to use the name of the place where such types have been first found in situ, "Eden Yuma" should apply to the long, thin type, as shown in Pl. XI, *a*, and some other name should be given to the other specimens shown in the same Plate. We suggest the name of "Scottsbluff Yuma" for the type shown in Pl. XI, *b*, since it was first found in situ in 1932 by a University of Nebraska party near Scottsbluff, Nebraska.[6] The specimen shown in Pl. XI, *c*, may be a variant of this type.

Oblique Yuma. Little is known about the second group in Miss Wormington's classification other than the flaking technique, which as the name suggests, consisted of the removal of oblique flakes from the face of the point. To my knowledge none has been found in situ, although this type occurs in the collection made by the Andersons near Yuma, Colorado. Until more is known about this type, it was decided to retain the name for the present.

Other types. The third group of the above classification was called "indeterminate Yuma," and by some "generalized Yuma." As these names imply, it has been difficult to define this group satisfactorily, particularly so as to exclude those which are similar in form, but which otherwise have no connection with the Yuma complex. Most of the confusion as to what a Yuma point is originates in this group. Some types, heretofore considered part of this large group, have a resemblance to the Folsom point. They are mostly smaller types, and in many cases made from flakes that were already too thin to have made it possible to remove a longitudinal flake.[7] One specimen of this type was found at the gravel pit at Clovis, and was removed in the matrix, where

[6] Barbour and Schultz, 1932*a*.

[7] Roberts, 1935, p. 18; Howard, 1933, Pl. 3, A, top row.

it rests in the edge of a bison vertebra. A similar specimen was removed in the matrix from Sandia cave.[8] Some authors have referred to this type as an "unfluted Folsom."[9]

There is also a larger type of unfluted point, heretofore referred to as a "generalized Yuma," which has been found at Clovis.[10] It answers the description of an "indeterminate Yuma" as used by Miss Wormington, except that it is as finely chipped as a Folsom, particularly the retouching along the edges. It has a straight base, straight sides, and a dorsal ridge, though not pronounced, suggesting the "Scottsbluff Yuma," without a stem. It is this type which we have thought might be a Folsom knife. On the other hand the Folsom knives, found in association with Folsom points at both the Clovis and Lindenmeier sites are nothing like this specimen. There is no reason to suppose that finely chipped, fully formed knives were not made by the Folsom people as well as the rather irregularly shaped knives, a few of which show fine flaking, which were found at Lindenmeier and Clovis. However this may be, we are inclined to believe that this particular type is more closely related to the "Scottsbluff Yuma" than to any other type. It might very well be a knife belonging to the "Scottsbluff Yuma" grouping.

But this still leaves a great variety of unfluted points which cannot be classed with the ones above, nor with the "Scottsbluff Yuma," "Eden Yuma," "fluted" point, nor yet with the Folsom. It will have to be admitted that we do not know enough about them to classify them satisfactorily under any of the groups which have been suggested so far. The Lone Wolf Creek[11] and the Brown's Valley[12] artifacts probably belong in the group.

Summary. To sum up our discussion thus far of the Folsom and Yuma problem in the light of the outline classification suggested at Sante Fe in September, 1941, we have two main groups: the fluted point and the parallel-flaked point. Under the former group come the Folsom, the Clovis fluted, and the Ohio fluted. Under the second group come the Scottsbluff Yuma, the Eden Yuma, and the oblique Yuma (provisional). Removed from the former category of the indeterminate Yuma is the small unfluted type which we suggest belongs in the Folsom complex, and the larger type which we believe to be a variant of the Scottsbluff Yuma (probably a knife). In faunal associations, at open sites, we have the extinct bison with the Folsom and the unfluted Folsom, and also with the Eden Yuma and the Scottsbluff Yuma. With the mammoth the association is with the Clovis Fluted. In caves, the associations differ somewhat from this pattern, as might be expected.

[8] Hibbin, 1941, Pl. 5, No. 2. [9] Schultz and Eiseley, 1935.
[10] Howard, 1935. [11] Cook, H. J., 1927; Figgins, 1927. [12] Jenks, 1937.

Finley Site Points

At the Finley site, we can say then, that we have the Eden Yuma, of which a typical example is Pl. XI, *a*, and Scottsbluff Yumas shown by the specimen shown in Pl. XI, *b*.[13]

It is surpising to find such a range, unmistakably associated in one small location as in the sandy clay at the Finley site. Placed in a series, as in Pl. XI, it can be noted that these specimens range from the long, narrow Eden Yuma to the wider, flatter, Scottsbluff type, in which the median ridge has practically disappeared, and the shoulders and stem have become more pronounced.[14] Several specimens give evidence that the tips had been broken, and then resharpened for further use. This should be borne in mind when making comparisons. The Plate previously published[15] also shows broad flat, triangular specimens, with their stems broken off, which can hardly be differentiated on the basis of parallel-flaked points. In fact, there is little to distinguish them from similar specimens that are found very widely distributed. We can make no suggestion regarding their place in this classification other than that they unquestionably belong in the complex, embracing the Eden and the Scottsbluff Yuma. We had hoped to continue our work in southwestern Wyoming during 1942, but the war put a stop to this. We believe that the region holds a number of clues regarding the relationship of Yuma and Folsom, and of migration routes from the Great Plains, through the Wyoming basin and beyond into the Basin and Range Province of Utah, Nevada, and California.

The archaeological data alone tell us little about the age of the Finley site. This we leave to the geological report by Dr. Hack. Moreover, there is no evidence that would leave us to believe that any one type of point found in place here is older than another; but that all were more or less contemporaneous in the sandy clay deposit. It will be noticed that no oblique Yumas were discovered here. In speculating upon the archaeological evidence, it appears that the Yuma points described are not as old as Folsom, although they were probably contemporaneous at other localities with the upper levels of the Folsom, and certain of the broader flatter types from the Finley site might very well have some connection with much more recent types than we had suspected.

University Museum
University of Pennsylvania
Philadelphia, Pennsylvania
April, 1942

[13] Howard, Satterthwaite and Bache, 1941.
[14] *Ibid.*, Pl. 10, also shows this transition.
[15] *Ibid.*

Antiquity of the Finley Site

John T. Hack

This report is based on two months' reconnaissance in the summer of 1941 in the Eden Valley, Wyoming. The work is as yet far from complete and the conclusions presented here must be regarded as tentative. It is hoped that in the future more extensive geological work may be undertaken.

The Finley site provides a promising opportunity for a determination of the age of the Yuma culture. The points and bones described by Dr. Howard occur in a culture layer which has been found in a large dune area, here called the Killpecker dunes. The deposition of the culture layer is one of a series of events in the dune area which can be correlated with the cutting and filling of gravel terraces in the Eden Valley to the west, and these in turn may be related to the glacial chronology in the Wind River Mountains which lie to the north.

The Finley site lies at the windward end of the Killpecker dune area. This dune area, shown in Fig. 19, is remarkable. It occurs in a cold region having a mean annual temperature of 37.6 degrees and a mean annual precipitation of 6.26 inches (Eden). The dune area is about six miles wide at the windward end, tapering to a narrow line of dunes one to two miles wide a short distance east. The dunes begin at the eastern margin of the Eden Valley and extend about sixty miles eastward, lapping over mesas and buttes, even crossing the continental divide at a low place between Steamboat Mountain and the Leucite Hills.

The largest part of the dune area is composed of bare sand devoid of vegetation except at the margins. This sand is shaped into high transverse ridges. At the windward end, from the Eden Valley to a line about seven miles east, the dunes are vegetation-covered and parabolic (or blowout) in form, some active, some stabilized. Vegetation-covered, stabilized, longitudinal dunes have been observed in the Red Desert near the leeward end.

The source of the sand of the Killpecker dunes is the Eden Valley. This broad valley, formed at the intersection of Big Sandy, Little Sandy, and Pacific Creeks, is covered by a thick deposit of sand and gravel containing numerous wind-cut stones. Most of the stones are composed of granite, quartzite, and gneiss derived from the Wind River Mountains. At present the Eden Valley is dissected by the three streams which once formed the alluvial plain and is supplying little sand to the dune area.

The sand which formed the dunes is probably glacial in origin, having been deposited in the Eden Valley during stages of alluviation

corresponding to periods of ice advance in the mountains. The dunes have been extended to leeward during intervening dry periods, just as they are at present, though little sand is at these times supplied at the windward end.

Chronology of Aeolian Deposition and Erosion

At the Finley site, which lies only a hundred yards from the windward edge of the Killpecker dunes, three aeolian deposits are exposed in the excavations and in nearby active blowouts (see Fig. 18). The oldest of these is a fine-grained greenish sand, which at the Finley site is over ten feet thick. At the top it is stained brown and black by iron and manganese oxides, a remnant of an ancient soil horizon formed under moist conditions. This sand is overlain by coarser and less compact buff-colored sand loosely cemented by calcium carbonate. The cement is concentrated at the top where the sand is firm and darker in color and represents a soil horizon formed probably under semi-arid conditions, which, however, as will be shown below, probably were wetter than those prevailing today. Also, this layer in many places, including the location of the site, contains clay deposited in water in dune hollows. This layer is the culture layer and contains Yuma artifacts as well as bison bones. Above the culture layer is a layer of loose yellow dune sand, irregular in thickness, which may be called recent dune sand, and which is now in motion in many places.

Inasmuch as these three layers or sands are exposed in several widely separated places in the windward portion of the Killpecker dunes they are probably widespread. They are not present in the larger area of active transverse dunes to leeward, probably because they have been destroyed.

In most of the vegetation-covered dune area the dominant vegetation is sagebrush and rabbit brush in varying proportion. Where these plants occur, the dunes are active and parabolic in shape, and test pits sunk into the sand generally reveal only recent dune sand. Around the Finley site, however, the dominant vegetation is greasewood and the dunes are more or less stabilized. At the site itself, a group of modern blowouts is activating these dunes and disclosing the older sand beneath, but round about it is clear that the sand has been stabilized for a long time. Furthermore, test pits in the greasewood-covered area reveal buff sand similar to the culture layer at the surface. The topography is not typical dune topography, but is irregular with numerous runnels and broad flat hollows in which clay has collected. This area then represents an area of water-eroded stabilized dunes, the last remnant of a once larger stabilized area formed during a period of stabilization which

preceded the present period of wind action and followed the deposition of the culture layer.

The dune chronology thus includes the following events: (1) Deposition of green sand by the wind. Nature of climatic conditions unknown. (2) Stabilization of dunes and formation of soil horizon containing iron and manganese oxides. Climate moist. (3) Occupation by Yuma peoples in this period or the one just following. (4) Deposition of buff sand by the wind, burying Yuma artifacts and bison bones. (5) Stabilization and erosion of the buff sand by running water and formation of soil horizon. Climate wetter than today, but presumably not humid. (6) Erosion of surface formed in fifth period and deposition of recent dune sand.

Gravel Deposits of the Eden Valley

The Eden Valley is a broad, more or less flat, plain covered by thick gravel deposits. It is formed at the intersection of Big Sandy, Little Sandy, and Pacific Creeks. These streams now flow in channels which average about fifty feet in depth. At one time, however, they flowed at a higher level on broad flood plains. The present stream system has developed by successive periods of cutting of the old flood plains, leaving a broad system of terraces. Measurements with a hand level at various points along the streams of the Eden Valley disclose several terraces which can be traced over wide areas:

1. Alluvial terraces. On Big Sandy, Little Sandy, and Pacific Creeks (but not Washington Draw) are low alluvial terraces underlain by clay and sand. In most places there are two, but at some places only one terrace is present.

2. Farson terrace. On Big Sandy, Little Sandy, and Pacific Creeks a low gravel-covered terrace, at places preserved only in narrow remnants, occurs at from ten to twenty feet above stream grade. Above the town of Farson this terrace is widespread, however, and makes up most of the area between Little Sandy and Big Sandy Creeks. During the Farson stage, Pacific Creek flowed through Washington Draw, and Little Sandy and Big Sandy Creeks joined somewhere above the town of Farson, there forming a broad flood plain. During the dissection which followed the Farson stage, Pacific Creek was captured by a tributary of the Little Sandy west of Tooley Butte and its water was diverted from Washington Draw to the Little Sandy. Thus, the Farson terrace forms the gravel floor of Washington Draw, now a broad and dry channel at the eastern margin of the Eden Valley. The Farson terrace is characterized by being somewhat less sandy than the higher terraces and is covered in many places by areas of clay.

3. Eden Valley terrace. On Big Sandy and Pacific Creeks is an ex-

tensive gravel terrace which lies from thirty to forty feet above the stream grade of Big Sandy Creek. This terrace forms an extensive plain south of the town of Farson between Big Sandy Creek and Washington Draw. It is sandy, contains abundant wind-cut stones and in many places is covered by dunes and large undrained depressions. During the Eden Valley stage Big Sandy, Little Sandy, and Pacific Creeks joined somewhere northeast of the present junction of Big Sandy and Washington Draw. The three streams formed a broad flood plain, probably covered by anastomosing channels.

4. Higher terraces. At least two higher gravel terraces occur at various places in the Eden Valley, from fifty to eighty feet above stream grade. Still higher pediment remnants covered by coarse gravels are also found.

The Farson stage is of greatest importance to the present problem, for it was during the Farson stage that Washington Draw was formed, adjacent to the Finley site. The Farson terrace is the lowest gravel covered terrace on the Big Sandy drainage. It can be traced beyond the Big Sandy Opening in the Wind River Mountains to an elevation of over 9400 feet.

The Eden Valley terrace can be traced as far as a large glacial moraine below Big Sandy Opening at an elevation of 9000 feet. Higher terraces extend upstream as far as Lecke Ranch at the foot of the Wind River Mountains where two large moraines occur.

Correlation of Dune Deposits with Terraces

The relationships at the windward end of the Killpecker dunes show clearly that all three dune sands, including the culture layer, rest on top of, and are younger than, the Farson terrace. Springs occur near the Finley site where a shallow valley has been cut into the floor of Washington Draw (Fig. 18). This valley is floored by sand, clay, and peat. All three of these are younger than the gravel of the Farson terrace which floors most of the draw. Auger holes reveal that beneath the clay is buff-colored sand, clayey sand, and, beneath that, greenish-white sand with limonite stains. Section 709-H (Fig. 20) serves as an example. The column obtained here extended to a depth of 75 inches, and showed the following strata:

37 inches grayish-pink clay,
6 " buff sand,
19 " buff clay,
11 " white sand with calcareous root tubes,
2 " white sand with limonite stains.

The white sand is correlative with the green iron-stained sand at the Finley site. It lies above the Farson gravel. The buff sand and clay represent the buff sand of the culture layer. The clay at the top is correlative with the period of stabilization and erosion of the buff sand. Peat is now forming on top of the clay. Water emerges from the sand beneath the clay and forms springs near the edge of the dunes.

The culture layer is clearly much younger than the Farson terrace, for all three dune sands with their two ancient soil horizons lie on top of the gravel of Washington Draw, deposited during the Farson stage. These relationships are shown diagrammatically in Fig. 21.

Moraines in the Wind River Mountains

A brief reconnaissance trip was made to the headwaters of Big Sandy Creek and only tentative conclusions can be reached concerning the substages of Wisconsin glaciation represented there. However, four moraines, all thought to be Wisconsin in age, have been found (cf. Fig. 19).

1. Below the Lecke Ranch a large area on either side of Big Sandy Creek is littered with boulders of granite and gneiss. These boulders do not form a well shaped moraine, but inasmuch as they rest on the variegated clays of the Wasatch formation their origin is presumably glacial. The elevation of this moraine (?) is approximately 7600 feet.

2. At Lecke Ranch is a more clearly formed moraine which crosses the Big Sandy in a great arc. It is now somewhat eroded and is dissected by streams. The elevation is 8050 feet.

3. At Big Sandy Opening is a fresh glacial moraine of large size with a pitted outwash plain upstream. It lies at an elevation of 9200 feet.

4. At Temple Lake in a cirque below Temple Peak is a small but fresh moraine. This moraine is about nine miles above Big Sandy Opening. It lies at an elevation of about 10,500 feet. The glacier which formed it was approximately one mile in length.

Working in the southern Rocky Mountains, L. L. Ray[1] has discovered four such moraines which he believes to be Wisconsin in age. In addition, he has discovered a fifth stage of colder climate which may be post-glacial represented by the widespread occurrence of pro-talus ramparts near the headwalls of cirques. This fifth stage was not observed during the writer's short visit to the Wind River Mountains. The moraine at Temple Lake is believed to be correlative with Ray's Long Draw substage (Wisconsin IV). This substage represents the highest

[1] Ray, 1940. See Bibliography, pp. 291–295, following.

and youngest group of moraines in the southern Rocky Mountains. In the Medicine Bow Mountains of Wyoming, which lie at approximately the same latitude as the southern end of the Wind River Mountains, Ray describes a moraine of this substage at an elevation of 10,500 feet, the same elevation as the Temple Lake moraine. Both are very near the lips of the cirques which supplied them.

TABLE 1
CORRELATION OF BIG SANDY DRAINAGE WITH RAYS'S CHRONOLOGY

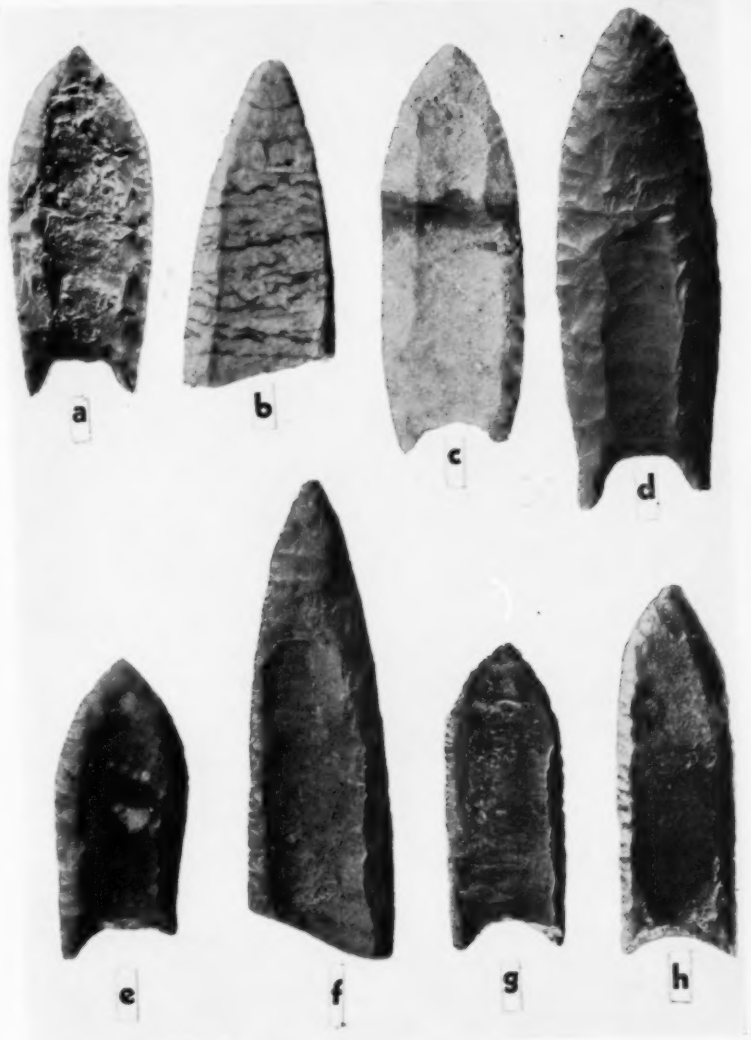
Wind River Mts.		Ray (1940)	
Elevation	Moraine	Southern Rocky Mts.	Continental Ice
?	?	Wisconsin V (Sprague)	Post-Glacial
10,500	Temple Lake	Wisconsin IV (Long Draw)	Cochrane
9,300	Big Sandy Opening	Wisconsin III (Corral Creek)	Tazewell-Cary (St. Johnsbury)
8,050	Lecke Ranch	Wisconsin II (Home)	Late Mankato (Harbor Hill)
7,500	?	Wisconsin I (Twin Lakes)	Iowan (Ronkonkama)

The correlation shown in Table 1, though reasonable, is obviously tentative. It must be checked by further studies in the Wind River Mountains. It is based on the briefest sort of reconnaissance.

Correlation of Moraines with Terraces

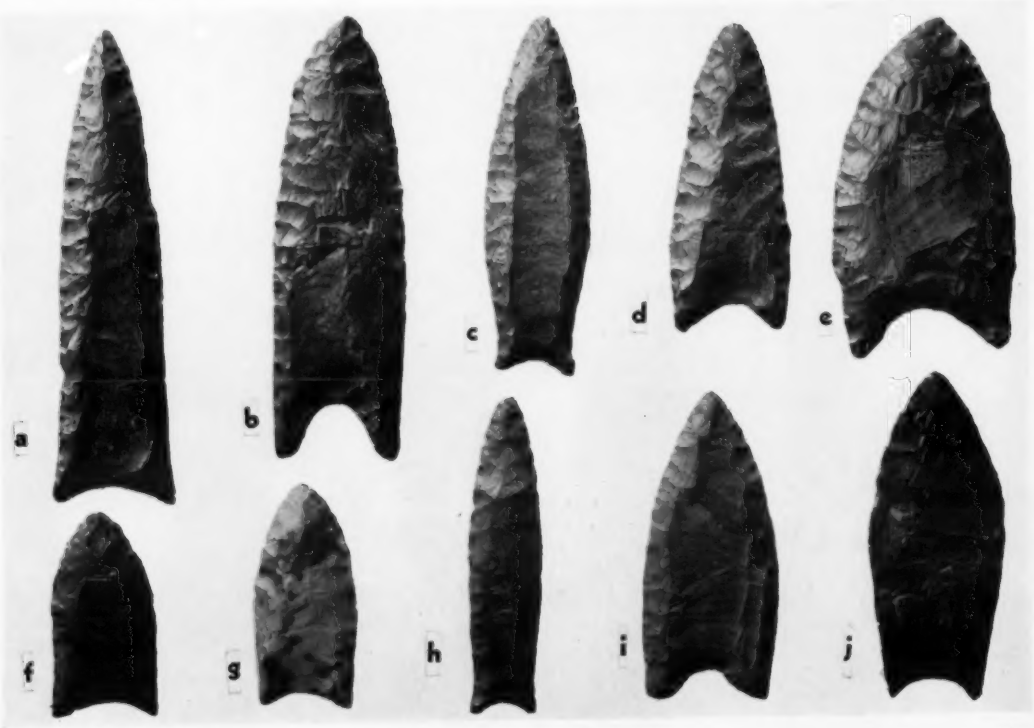
The Farson terrace is the lowest gravel terrace on Big Sandy Creek. Except for a gap of about fifteen miles below Lecke Ranch, it has been traced from Farson upstream through the Big Sandy Opening moraine for several miles above it. It probably, therefore, represents the ice advance corresponding to the moraine at Temple Lake. Below Big Sandy Opening two terraces are found, the higher one representing the Eden Valley terrace. Several still higher terraces occur below the moraines at Lecke Ranch.

Thus, the Farson terrace is probably correlative with the Temple Lake moraine, the youngest moraine found in the Big Sandy drainage. It is reasonable that this moraine represents the last Wisconsin ice advance and corresponds to Ray's Long Draw, or Wisconsin IV sub-



"Folsom Fluted" points, *a–c*, from type site.

"Clovis Fluted" points.



"Ohio Fluted" points, *b*, *g*, from Ohio, courtesy T. B. Stewart, Lockhaven, Pennsylvania; *a*, *c–h*, *j*, from Ohio, courtesy Ohio State Museum. (Approximately $\frac{3}{16}$ actual size.)

Fluted Points: *a*, "Eden Yuma"; *b*, "Scottsbluff Yuma"; *c*, variant form of "Scottsbluff Yuma."

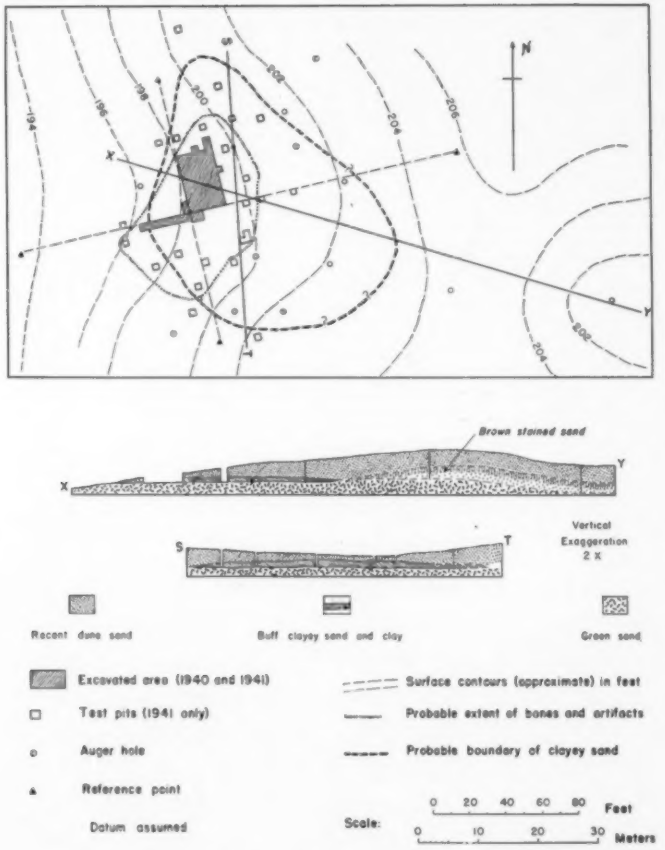


FIG. 18.—Map of Finley site, showing trenches, test pits, and auger holes of 1941 season (plane table survey by Howard and Hack).

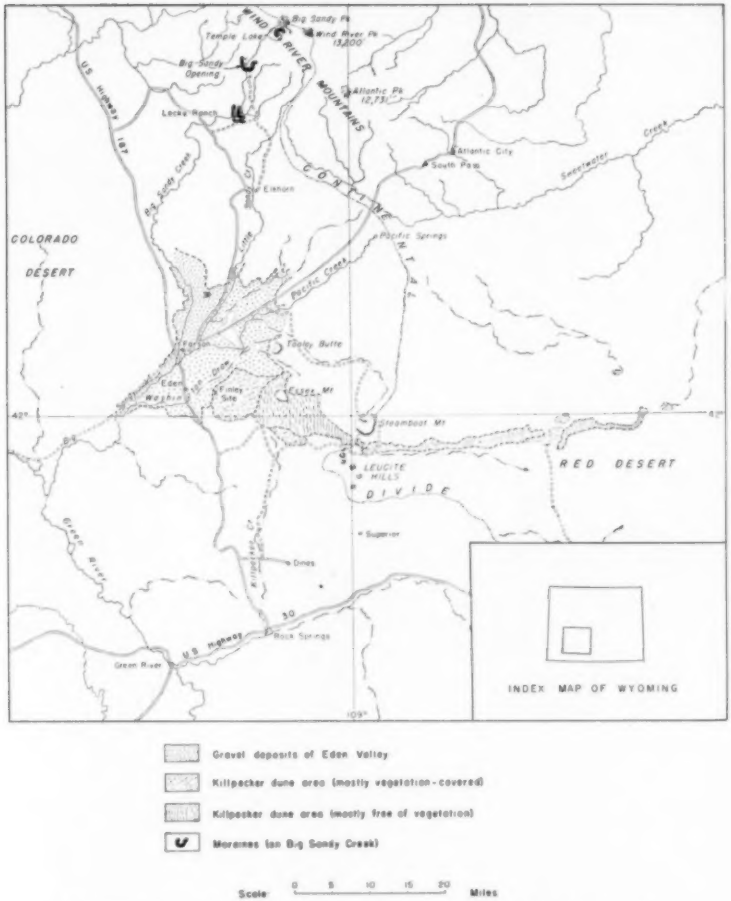


FIG. 19.—Map of a portion of southwestern Wyoming showing moraines, Eden Valley gravel deposits, and Killpecker dunes.

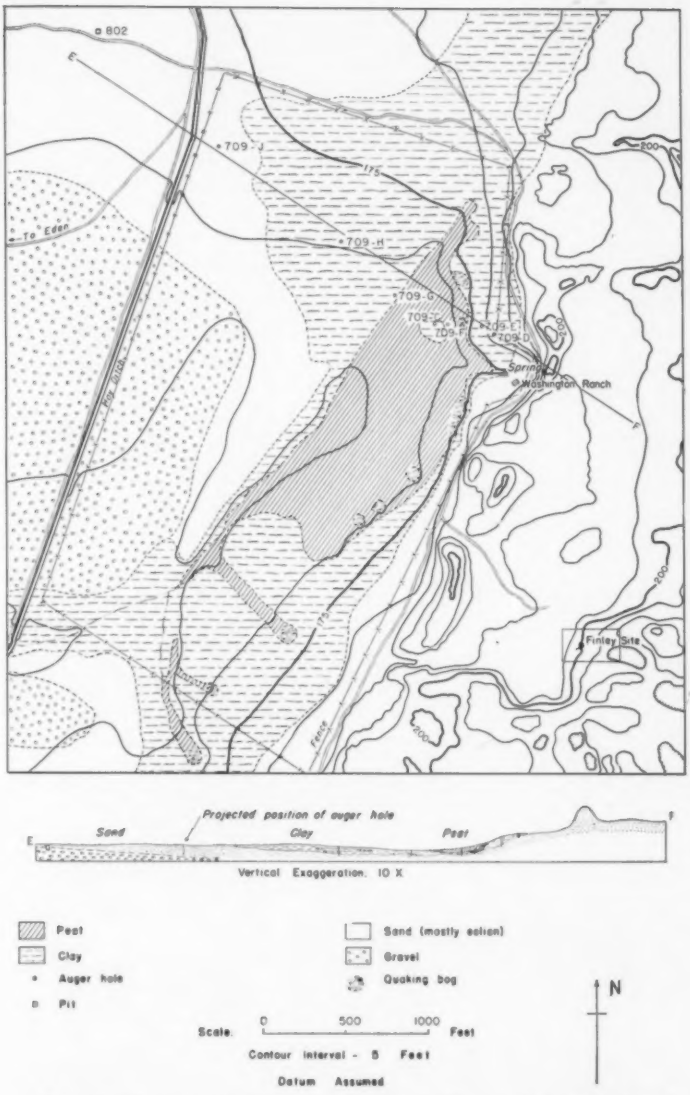
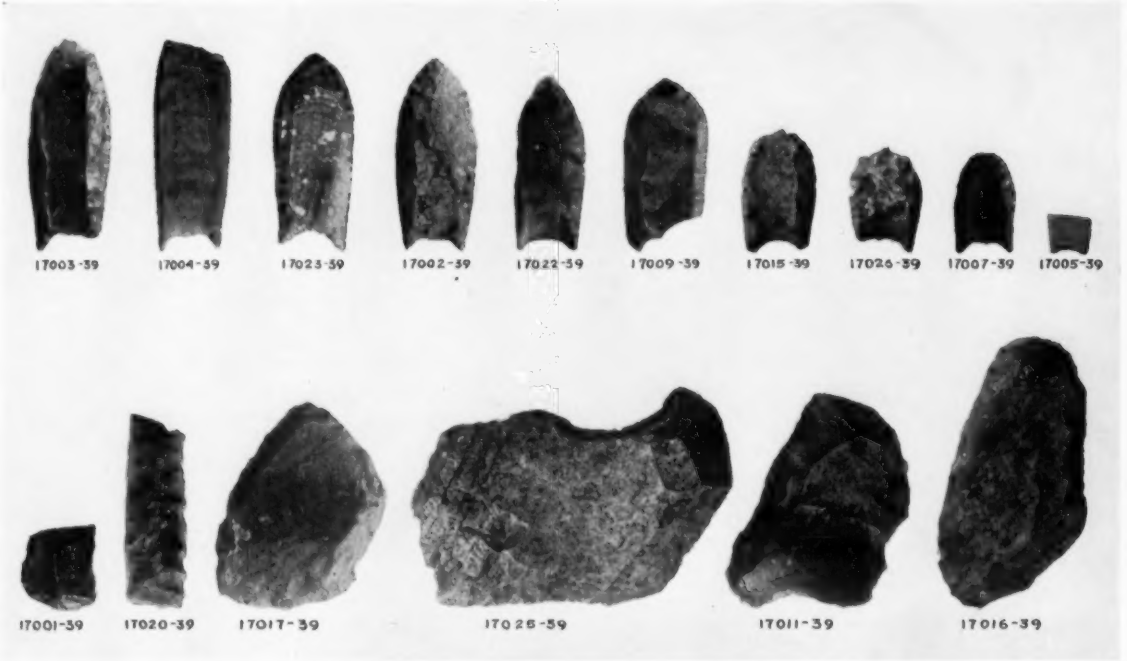


FIG. 20.—Topographic and geologic map of the east side of Washington Draw and area surrounding the Finley site (plane table survey by Hack, Howard and Dudek).



Artifacts from the Lipscomb Bison Quarry (approximately ½ actual size).

stage. Inasmuch as there is a stretch of fifteen miles of the Big Sandy River which has not been studied, it is possible that this correlation is in error, but it is the most probable.

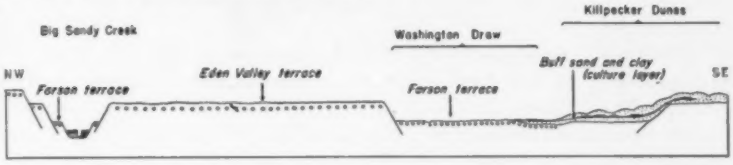


FIG. 21.—Diagrammatic cross-section of Eden Valley (not to scale).

Conclusions

The present study indicates that the culture layer at the Finley site is younger than the Farson terrace. This terrace was probably formed during the last Wisconsin ice advance (Wisconsin IV). It is, therefore, probable that the culture layer is post-glacial in age. According to Bryan and Ray,[2] the culture layer containing Folsom artifacts at the Lindenmeier site is Wisconsin III in age and it is, therefore, apparent that the Eden Valley Yuma is considerably younger than the Folsom site at Lindenmeier though the two cultures may have occupied a long period of time.

Defining the age of the culture layer at the Finley site more closely than putting it in the post-glacial is a more intricate problem which must await further study. However, during the post-glacial (post-Farson) it is clear that a complex series of events related to climatic changes occurred. Two soil horizons, presumably representing moister conditions than prevail today, separate three layers of dune sand. The culture layer lies between these two soil horizons.

The problem is complicated by the fact that there is as yet no evidence as to what conditions were responsible for the movement of sand at the windward end of the Killpecker dunes and what conditions caused stabilization. Did sand move during the periods of ice advance under the influence of a periglacial climate and become stabilized as the ice retreated and the climate ameliorated? It is conceivable and likely that the dunes may also have been activated by a dry period such as probably occurred during the post-glacial optimum of climate. Further study in the Eden Valley area may solve these problems and it promises to reveal much of the climatic history of post-Farson or post-glacial time.

U. S. Geological Survey
Washington, D. C.
April, 1942

[2] Bryan and Ray, 1940.

Artifacts from the Lipscomb Bison Quarry (approximately 3 actual size).

SOME ARTIFACT SITES OF EARLY MAN IN THE GREAT PLAINS AND ADJACENT AREAS

C. BERTRAND SCHULTZ

DURING the past fourteen collecting seasons, paleontological expeditions of the University of Nebraska State Museum have excavated a large number of sites which contained the bones of extinct mammals associated with the artifacts of Early Man. Many of these sites have been reported[1] but some data have not been published. All of the studies of Early Man have been carried on from a paleontologic and stratigraphic point of view. It is hoped that a faunal and stratigraphic sequence connecting the Pleistocene and Recent will eventually be established, and that Early Man's relation to this sequence will be determined. It is the purpose of this brief paper to summarize the work relating to Early Man which has been done by the field parties of the University of Nebraska State Museum since 1937. The explorations have been confined chiefly to Nebraska, New Mexico, Texas, and Wyoming.[2] Since the studies of the Nebraska sites have, for the most part, been published,[3] the discussion will be confined to the sites in the latter three states.

NEW MEXICO

Guadalupe Mountains. The caves of the Guadalupe Mountains were investigated in both New Mexico and Texas by field parties from the University of Nebraska State Museum during the field seasons of 1937, 1938, 1939, and 1940. Conditions brought about by the present war have prevented a completion of the work in that area.

In 1937, Dr. Edgar B. Howard of the University of Pennsylvania Museum and Mr. R. M. P. Burnet of the Carlsbad Museum of Carlsbad, New Mexico, invited the writer to bring a field party to New Mexico to aid in the exploration of the caves of the Guadalupe Mountains. Dr. Erwin H. Barbour, then Director of the University of Nebraska State Museum, arranged for a preliminary investigation in 1937 and sent the writer to the cave area in hope of securing a collection of fossil mammal remains from the late Pleistocene.

[1] Barbour and Schultz, 1932*a*; 1932*b*; 1936*a*; 1936*b*; 1937; 1941; MacClintock, Barbour, Schultz, and Lugn, 1936; Meserve and Barbour, 1932; Schultz, 1932, 1937, 1938, 1940; Schultz and Eiseley, 1935, 1936; etc. See Bibliography, pp. 291–295, following.

[2] During 1940 and 1941 the Nebraska Museum also had field parties exploring and working in caves in north central Arkansas in the Ozark Mountains but no evidence of Early Man has been encountered. Much Pleistocene fauna, however, has been excavated.

[3] See footnote 1.

Many caves of the Guadalupe Mountains had been investigated by Dr. Howard[4] and Mr. Burnet previous to 1937. During that year the writer and his wife, representing the University of Nebraska, joined the expedition of the University of Pennsylvania Museum and the Academy of Natural Sciences of Philadelphia and worked with Dr. Howard and Mr. Burnet. Several cave sites, including Burnet Cave,[5] were investigated and partly excavated. Burnet Cave had already produced the remains of sixty different kinds of fossil vertebrate animals in association with numerous hearths. A Folsom-like point had also been found in direct association with bones of extinct mammals. The 1937 excavations in the cave yielded many forms of fossil vertebrates that had not been previously reported, thus definitely giving Burnet Cave the distinction of having the largest fauna in America associated with Early Man. This record still stands in 1942.

During the summers of 1938, 1939, and 1940 the cave work in the Guadalupe Mountains was carried on by field parties from the University of Nebraska in cooperation with Mr. R. M. P. Burnet. In 1938, one of the caves, Hermit's Cave, was investigated jointly with a field party from the New Mexico State Museum. Mr. Edwin Nelson Ferdon, Jr., from the New Mexico State Museum, had charge of the archaeological work and has prepared a detailed report on the human occupational layers which were encountered above the fossil mammal horizon in the cave. The remains of numerous extinct mammals similar to those from Burnet Cave[6] were uncovered in the lower levels of the cave floor, and a paper concerning these fossils has been prepared by the present writer. Well preserved bones of proboscideans and the dire wolf (*Canis dirus*) were found in Hermit's Cave. This was the first reported occurrence of these forms in the caves of the Guadalupe Mountains. Charcoal and burned wood were associated with the bones of extinct mammals in Hermit's Cave. Some of the bones were split and broken, and even burned, as they were in Burnet Cave, but no artifacts were found.

Since 1937, more than a dozen caves have been excavated and over six thousand numbered specimens from these caves have been collected in the Guadalupe Mountains by field parties from the University of Nebraska. The University is indebted to the United States Department of Agriculture for permission to work on its lands in the Lincoln National Forest in the Guadalupe Mountains during the four years 1937 to 1940.

Jal Horse Quarry. A new fossil locality south of Jal, Lea County,

[4] Howard, 1931; 1932; 1935*a*; 1935*b*; 1935*c*.

[5] Howard, 1932; 1935*a*; Schultz and Howard, 1935.

[6] Schultz and Howard, 1935.

New Mexico, was investigated by the writer in 1940. This site, called the Jal Horse Quarry, was discovered by Mr. Shafter Ward of the New Mexico Highway Department of Carlsbad. Preliminary work showed that the fossilized remains of a number of large extinct mammals were eroding out of a clay and silt deposit. Similar deposits had been reported from Clovis,[7] New Mexico. At the Jal site several skeletons of a Pleistocene horse (*Equus* sp.) were eroding out of the bone layer, and remains of a giant sloth (?*Mylodon*), camel (*Camelops*), bison (*Bison antiquus taylori*), cat (?*Smilodon*), mammoth (*Parelephas columbi*), and mastodont (*Mastodon americanus*) were exposed. In making test pits, chips of flint, some highly patinated, were encountered in the bone deposit.

TEXAS

Guadalupe Mountains. A summary of the work of the University of Nebraska State Museum in the Guadalupe Mountains will be found in the discussion under New Mexico. Only about a fifth of the exploration time was spent in the Texas portion of the Guadalupes, and no definite association of artifacts with the remains of extinct mammals was found. The excavation of William's Cave[8] south of the Point of the Guadalupes was completed in 1939, and several new records were added to the faunal list. Other caves west of the Point were excavated because they contained quantities of sloth (*Nothrotherium*) dung, but no fossils were found.

Lipscomb Bison Quarry.[9] The Lipscomb bison locality was reported to the writer in the fall of 1938 by Mr. Charles H. Falkenbach of the Frick Laboratory, American Museum of Natural History, but the site was not investigated until the spring of the following year. On May 20, 1939, the locality was visited by a field party consisting of Messrs. Charles H. Falkenbach, John C. Blick, and N. Z. Ward of the Frick Laboratory, and Messrs. John Adams, E. E. Brier, Lynn Robert Wolfe, and the writer, all of the University of Nebraska State Museum.

A careful examination of the bone deposit showed that the remains, although very near the present surface of the ground, were well fossilized and at one time had been deeply buried. The bones appeared to be larger than typical *Bison bison*, and since the members of the staff of the University of Nebraska State Museum were anxious to obtain comparative material of late Pleistocene and early Recent bison, excavating

[7] Howard, 1935*a*; 1935*b*; 1935*c*; Cotter, 1937. [8] Ayer, 1936.

[9] Schultz, 1940, pp. 35–36; Sellards, 1940, p. 403; Barbour and Schultz, 1941, pp. 67–68. Locality: sixteen miles north of Canadian, near Lipscomb, in Lipscomb County, Texas; on the farm of Mr. Commadore Hopper, on north side of Sand Creek, a branch of Wolf Creek, which is tributary to the North Canadian River.

privileges were obtained from the Frick Laboratory in exchange for rights in certain Nebraska fossil quarries.

The members of the field party making this preliminary investigation found a "snub-nosed" scraper (Pl. XII, No. 17001-39) in situ among the bones protruding from the bank, but this type of artifact was, of course, not diagnostic. On the slope of the hill west of the bone deposit, however, a fragment of a Folsom point (No. 17000-39) had been previously found on the surface, so it was considered a possibility that more artifacts would be encountered when the bones were excavated.

An expedition composed of Messrs. John Adams, William Hendy, and James Crosby was sent later from the University of Nebraska to the Lipscomb Bison Quarry, as the site was first called in the field records. The group arrived at the site on June 10 and work continued at the quarry until August 26. Messrs. Harry Tourtelot and Robert Kubicek joined the party on July 31 and assisted in the work. The writer and his wife, Marian Schultz, visited the quarry three different times during the summer, and aided in the excavating. Dr. and Mrs. Loren C. Eiseley of the University of Kansas, Dr. and Mrs. E. H. Sellards of the University of Texas, and Mr. Floyd Studer of Amarillo, Texas, were visitors at the site during the excavations.

The location of the bones had been known for at least twenty years by persons in the neighborhood, and some excavating had been done by local citizens. There was no visible excavation showing previous work but undoubtedly the numerous bones and bone fragments in the talus below the outcrop were the result of digging rather than erosion.

Excavations were begun on the west side of the deposit in the area where the bones were the thickest. A trench was started but it soon became evident that this method of removal would have to be altered because there were a number of articulated skeletons in the quarry and the bones lay close together. The quarry was marked off in five-foot squares and the outlines of the various important specimens were plotted on a large-scale sketch map. A topographic map was also made showing the region along Sand Creek in the vicinity of the site. Several terraces are well developed along this drainage, and the bones appear to be located in the highest (35 to 45 feet), or oldest, of these.

Most of the overburden covering the bones had been removed as a result of erosion by wind and water, only six or seven inches remaining at the northeast side of the deposit and thirty inches at the southeast edge. On the west side, where the bones were exposed along the bank, the depth of the deposit varied from seven to fifteen inches. The bones nearest the surface were in a poor state of preservation because of the penetration of grass roots.

The quarry extended for a distance of approximately one hundred feet from north to south and twenty feet from east to west. At the north end of the quarry the fossils were badly broken and scattered, but those to the south were mainly complete and in most cases articulated. Fourteen articulated skeletons, including skulls, were located in a section which was only twelve feet wide and twenty feet long. The skeletons were headed chiefly in an easterly or southerly direction and overlapped

TABLE 1

DESCRIPTION OF ARTIFACTS FROM LIPSCOMB BISON QUARRY

Field Number	Type of Artifact	Position when discovered	Maximum length*	Maximum width	Width at base††
17000-39	Fragment of projectile point	In quarry talus			
17001-39	"Snub-nosed" scraper**	In situ with bones	25.5	23.5	
17002-39	Projectile point**	In situ with bones	53.5	23.5	18.1
17003-39	Projectile point**	In situ with bones	61.0	23.6	18.9
17004-39	Projectile point**	In quarry talus	68.0†	21.8	17.6
17005-39	Base of projectile point**	In quarry talus			11.3
17006-39	Base of projectile point	In situ with skull			16.5†
17007-39	Projectile point**	In situ with bones	28.4	17.5	16.3
17008-39	Fragment of projectile point	In situ with bones			
17009-39	Projectile point**	In situ with bones	51.0†	23.7	21.0†
17010-39	Tip of projectile point	In situ with bones			
17011-39	Side scraper**	In quarry talus	71.5	45.2	
17012-39	Seven chips	In situ with bones			
17013-39	Four chips	In situ with bones			
17015-39	Projectile point**	In situ with bones	37.0†	21.1	17.9
17016-39	Side scraper**	In situ with bones	85.2	44.0	
17017-39	Side scraper**	In situ with bones	65.6	45.5	
17018-39	Tip of projectile point	In situ with bones			
17019-39	Fragment of projectile point	In situ with bones			
17020-39	Channel flake**	In situ with scapula	54.0	18.0	
17021-39	Base of projectile point	In situ with skull			21.5
17022-39	Projectile point**	In situ with skull	50.2	20.0	17.4
17023-39	Projectile point**	In situ with bones	57.8	23.8	19.0
17024-39	Tip of projectile point	In situ with bones			
17025-39	Side scraper**	In situ with bones	98.0	62.9	
17026-39	Projectile point**	In situ with bones	33.0†	20.7	16.6
17027-39	? Flake knife	In situ with bones	29.9	15.2	
17028-39	? Flake knife	In situ with bones	33.6	13.9	

* All measurements in millimeters. ** Figured in this paper.
† Estimated. †† Measured across base of channel.

one another, considerably. Nine additional skulls were unearthed in the area immediately surrounding the skeletons. The skeletal remains of some individuals were entire, even including the caudal vertebrae. From a paleontological standpoint, the Lipscomb Bison Quarry is an important site because of the completeness and preservation of the bones, including skulls. At the original Folsom quarry in New Mexico many of the bones were crushed and incomplete, and accurate measurements were difficult to obtain.

Twenty-two artifacts and a number of flint chips, all in situ, were found scattered throughout the quarry. Four additional specimens were recovered from the quarry talus. The artifacts compare favorably with those of the Folsom complex which Dr. Frank H. H. Roberts, Jr.,[10] reported from the Lindenmeier site in Colorado, but show much more variation in form than do those from the original Folsom locality.[11] Some of the most diagnostic specimens from the Texas site are figured in Pl.

TABLE 2

ONE OF LARGEST MALE SPECIMENS,* *BISON ANTIQUUS TAYLORI*, LIPSCOMB BISON QUARRY, TEXAS

	mm.
SKULL	
Length from posterior of the occipital condyles to anterior of premaxillae	596
Length from anterior notch of foramen magnum to anterior of premaxillae	554
Length from middle of occipital crest to anterior of premaxillae	635
Length from middle of occipital crest to posterior of nasals	283
Distance from upper border of foramen magnum to middle of occipital crest	122
Distance from top of occipital crest to inferior articular surface of condyles	180
Width of occipital region at external auditor meatus	296
Width of skull at constriction between orbits and bases of horn-cores	330
Distance (min.) between orbits	306
Width across facial protuberances	217
Distance across skull below infraorbital foramen	170
Distance between bases of horn-cores, on anterior side	435
Distance between bases of horn-cores, on posterior side	405
Diameter of base of horn-cores, fore-and-aft (not including burr or rugose swelling)	97
Diameter of base of horn-cores, vertical (not including burr or rugose swelling)	95
Circumference of horn-cores, around burr at base	330
Length of curve along outer surface of horn-core	(375)†
Length of curve along inner surface of horn-core	(310)
Distance between tips of horn-cores	(960)
Length of nasals	236
Width (max.) across nasals	111
Diameter (max.) of orbits	78
Width of occipital condyles	148
Length of molar-premolar series	170
MANDIBLE	
Length from posterior of condyle to anterior of incisors	(500)
Depth below anterior of third inferior molar	71
Length of inferior molar-premolar series	170

* No. 1-8-8-39, The University of Nebraska State Museum.
† ( ) =approximate.

XII, and all of the archaeological material recovered is listed in Table 1. One of the chips (17013-39) which was found in situ in the quarry resembles the "gravers" found by Roberts,[12] but no evidence of worked bone was observed. The artifacts are made of a light to dark gray flint and flinty chalcedony which is occasionally streaked with red.

Charcoal and ashes were associated with the bones in many parts of

[10] Roberts, 1935; 1936; 1938. [11] Cook, 1927; Figgins, 1927.
[12] Roberts, 1935, Pl. 13.

the quarry, especially in the southern portion, where there was evidence of individual fires. Along the north and east sides of the deposit the bones were scattered and many of them had been split and cut by the ancient hunters. The artifacts as well as the bones often were incrusted with lime on the lower side and the flint itself was found to be deeply patinated. Some large pieces of limestone, foreign to the immediate area, were uncovered among the bones in the northern part of the quarry, and small limestone fragments were scattered throughout most of the quarry. The stones may have been employed in the breaking and shattering of the bones.

The chips of flint found in the quarry would suggest that tools were resharpened at the site, but the presence of the complete channel flake (Pl. XII, No. 17020-39) of a Folsom point would not necessarily mean that projectile points were made there. This flake had probably been used as a knife by the hunters.

It is difficult to postulate why so many articulated animals had been left in the concentration which was mentioned in a previous paragraph. Perhaps there was more food than was necessary, and after the butchering of a sufficient supply had been completed, only the pelts were taken from the remaining animals. Burial must have taken place shortly afterward, or the carnivores would have dismembered the skeletons.

Thirty-eight boxes and crates of fossil bison material were collected from the Lipscomb site to add to the Morrill Paleontological Collections. Although the specimens show a great amount of variation, they compare favorably with the collection of *Bison antiquus taylori* from the Folsom Quarry in New Mexico (see Table 2). There is a certain amount of overlapping in the size and form of the smallest Lipscomb individuals and modern *Bison bison*. The bison material from Lipscomb is also being compared with the extensive collection from the Scottsbluff Bison Quarry[13] in western Nebraska, where Yuma points were collected in 1932, in order to determine whether the bison associated with the two artifact complexes differ from each other.

WYOMING

Eden. A fossil bison locality near Eden, Wyoming, was reported to the writer in March, 1940, by Mr. O. M. Finley of Eden. In 1932 Mr. Finley, who at that time lived in Scottsbluff, Nebraska, visited the University of Nebraska field party excavating at the Scottsbluff Bison Quarry[14] and saw some Yuma points which were found associated with the bison bones. Mr. and Mrs. Finley had visited the quarry when one of

[13] Barbour and Schultz, 1932; Schultz and Eiseley, 1935; 1936.

[14] Barbour and Schultz, 1932*b*.

the points was still in situ in the gravels of the bone layer. This was a long point[15] with slight shoulders at the base, and when in 1940 Mr. Finley found similar points associated with quantities of fossil bison bones, he recalled his earlier experiences. Examples of the bones and sketches of the points were forwarded to the University of Nebraska. Arrangements to work the site could not be made immediately, so Dr. Edgar B. Howard of the University of Pennsylvania Museum and Mr. Harold Cook of Agate, Nebraska, carried on preliminary excavations at the site.[16]

During 1941, a joint expendition of the University of Pennsylvania and the University of Nebraska worked the bison quarry and obtained several additional Yuma artifacts, as well as more complete fossil bison remains than had been found in 1940. The bison bones compare favorably with those from the Scottsbuff Bison Quarry and have tentatively been identified as *Bison antiquus taylori*. Work in the quarry during 1942 was carried on by the University of Nebraska.[17]

Gurnsey Caves. There are several caves in the Hartville Uplift area north of Gurnsey, Wyoming, which have been partially excavated by University of Nebraska field parties during 1940 and 1941. In one cave charcoal was found associated with the fossilized bones of *Equus* and other mammals, but no artifacts were recovered.

The University of Nebraska State Museum
Lincoln, Nebraska
June, 1942

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[15] Barbour and Schultz, 1932*b*, Fig. 169. D; Schultz and Eiseley, 1935, Pl. 8, D.

[16] Howard, 1941.

[17] Several new Yuma localities were encountered in Sweetwater County, Wyoming, during August, 1942, by a Nebraska field party. One camp site already has yielded over 200 Yuma type dart points in association with hearths and fossilized bones. Work at these new sites has been discontinued until after the war.

A FOLSOM SITE IN A MOUNTAIN VALLEY OF COLORADO

C. T. HURST

WITHIN recent years it has become increasingly clear that the antiquity of man in America can be pushed back to respectably remote periods of time. The evidence for this is now beyond reasonable question. The original Folsom find, as well as the more recent Lindenmeier excavations, among others, have established the general status of the Folsom culture complex involved. The work at Gypsum Cave has added to the picture of early man in America, and that at Sandia Cave also shows clear-cut evidence that cannot be ignored.

Taken as a whole, the facts that have been accumulated by various workers in various parts of the field point clearly to man's presence in America during post-glacial time. Whether or not his presence may date back to interglacial time remains to be answered one way or another on the basis of further facts yet to be uncovered.

The purpose of the present short paper is to reiterate for a wider audience a record of a very definite situation that exists in a mountain valley in Colorado—the great San Luis Valley of the south-central part of the state.[1]

The Pleistocene ice sheets advanced and retreated repeatedly from their centers in northeastern and north central North America, apparently leaving an ice free corridor east of the Rocky Mountains northward to the Yukon-McKenzie country. Glaciers of far greater extent than shown by the few present day remnants hung in the mountains, as evidenced by the Pleistocene deposits. The Pacific Coast may have had, in Pleistocene times, a climate relatively milder than that in the interior. If man originally came from Asia, as he undoubtedly did, he may have found two possible pathways over which he could have slowly filtered to the south—the coast and the inland corridor. In one or the other or both of these pathways earliest man should have left his traces.

During the ice age and for some time since, the fauna in many places was characteristically that of a cooler climate, and included the mammoth. The horse, bison, camel, and ground sloth are included among the extinct animals hunted by early man. The plains and foothills of Colorado lying on the eastern margin of the Rockies doubtless furnished very favorable stopping places, on account of the abundance of game and favorable climatic conditions. The same would have been true farther south in New Mexico, and possibly also farther north in Wyoming,

[1] The first publication of these facts was in Hurst, 1937; 1941. See Bibliography, pp. 291–295, following.

although to a lesser degree. Less favorable climatic conditions in the north would suggest that remains of early artifacts may be scantier. As mountain glaciers retreated, minor migrations of Folsom and other people may have occurred from both the foothills area to the east of the mountains and from the Pacific marginal area. Very old remains in intramontane locations can be explained adequately in no other way.

Folsom and Yuma points have been picked up in the San Luis and the Gunnison Valleys in Colorado by individuals in one way or another associated with the archaeological activities of the writer. Both these valleys are separated from the plains by intervening high mountains that in places exceed fourteen thousand feet in altitude. Mammoth bone has been found in at least nine places in the San Luis Valley and at one place in the Gunnison Valley. A mammoth tooth and a tooth of an extinct bison were also found in the latter valley.

These finds proved nothing at the time, but spurred us on to search for an association of the remains of extinct animals and the handiwork of man that would be on one spot and in definite juxtaposition.

Should such an association be found, it would not necessarily establish a degree of antiquity equal to that of some of the other Folsom sites. It may have been that semi-Ice Age conditions persisted for a longer time in the higher altitudes. This may have meant that the mammoth, for instance, survived longer in the interior valleys than it did east of the mountains.

Our long-hoped-for and long-sought association of Folsom artifacts with extinct mammalian material finally came to light in definite form in May of 1941. During that month, a Folsom location in the Sand Dunes of the San Luis Valley was excavated by the writer in company with four other workers from Monte Vista, Mr. Al Pearsall, Mr. Gene Sutherland, Mr. Carl Erickson, and Mr. Leslie Dunnells, all of them associated with the Rio Grande Chapter of The Colorado Archaeological Society in that city. The site lies to the west of the lofty Sangre de Cristo Range, in Alamosa County on the ranch of the Linger brothers.

Up to the present time, only a few scattered Folsom points have been reported from Colorado west of the junction of the mountains and the plains. None of them were reported as associated with the remains of extinct animals. The San Luis site presents a definite association with the remains of what may be *Bison taylori*.

The site is a blowout which has almost reached the level of an old waterhole where bison had apparently been accustomed to come for water. The blowout is roughly fifty yards across. The skeletons of five bison appeared on the surface. They were so badly disintegrated that the bones were crumbled, only small chips of tooth enamel remaining.

However, in excavating, one cannon bone (right metacarpal) and several teeth were recovered more or less intact. These were sent to the American Museum of Natural History for identification.[2]

In a letter dated July 9, 1941, Dr. Granger said: "Comparison between the right metacarpal of your specimens with the corresponding bone of the skeleton of *Bison taylori* we are now mounting shows the Sand Dunes bone to be slightly larger than that from the type locality. It will, of course, be necessary to make comparison with modern bison also." Later, on July 31, Dr. Simpson wrote as follows: "First, your specimens cannot be distinguished from *Bison taylori* and could belong to that species. It is not certain that they do. Second, your specimens are probably but not surely representative of an extinct species. They are well away from the average for modern bison, and may be, but are not proved to be, outside the limits for recent bison."

Orthodox excavation procedures were impossible owing to the nature of the substratum which was pure sand and could only be handled by "skimming" and screening. Buffalo remains were sifted until entirely sterile sand was encountered. The maximum depth at which crumbled bone lay was two feet. This was true only in one place, all the rest of the material lay less than one foot below the surface.

In all, twenty-two Folsom stone artifacts have been recovered from this blowout. These are shown in Plate XIII plus a point (atypical) picked up nearby (Pl. XIII, 4). Specimens in Plate XIII, 1–3, 5–11, were picked up from the surface of this particular blowout by Mr. Sutherland during several previous years and in immediate association with the emerging bones. The basal part of a Folsom point (Pl. XIII, 22) was similarly recovered by Mr. Jack Nelson. Two scrapers (Pl. XIII, 13 and 15) were recovered in a test pit that was sunk into a skeleton during the fall of 1940. All the rest of the artifacts (Pl. XIII, 12, 14, 16–21, 23) were recovered from below the surface among the crumbled bones, in the operations of May, 1941. This fact would seem to preclude any possible doubt about a definite association of the Folsom material with these particular animals.

Data on the twenty-three artifacts illustrated in Pl. XIII follow:

1. Blade; length 2⅛ in.; width ¾ in. at midpoint; thickness $\frac{7}{32}$ in.; brownish jasper; flaking only partially diagonal, "ripple"; base broken; rudimentary channel at base; microscopic retouching. (Formerly "generalized" Yuma. This type removed from the Yuma complex at the symposium at Santa Fe, Sept. 3, 1941.)

2. Folsom point complete; length 1½ in. including "ears"; width $\frac{11}{16}$ in. at base; thickness ⅛ in. on ridges; yellowish jasper; channeled on both sides; base thin and sharp.

3. Scraper; greatest width 1½ in.; brownish-yellow jasper; microscopic retouching; edge flat underneath; rest of scraper with torque; upper side fits thumb, lower side index finger at right angle to thumb.

4. Atypical point complete; length 1$\frac{5}{8}$ in.; width at midpoint $\frac{15}{16}$ in.; thickness $\frac{5}{16}$ in.; milky chalcedony; crude chipping; channels slight but evident; one well-defined and one small basal notch; base blunt.

[2] Tentative identification was most kindly made by Drs. Walter Granger and George G. Simpson.

5. Folsom point complete (unfinished?); length 1¼ in.; width ⅝ in. at widest point; thickness 1/4 in. on ridges; tannish-yellow quartzite; channels both sides; chipping neat; "ears" not yet added (base *not* broken); base of uniform thickness with rest of channels.

6. Folsom point tip; length 1 3/16 in.; width ⅝ in.; thickness 1/8 in. on ridges; mottled reddish chalcedony, channeled both sides to tip, one side deeper; flaking not finely done.

7. Folsom point base; length 1⅛ in.; width ⅝ in. at widest point; thickness 1/4 in. on ridges; reddish chalcedony; deeply channeled on one side, rudimentary channel on other side—rest of this side convex; chipping good; "ears" not symmetrical; base thick.

8. Folsom point (broken); length 1 ⅝ in. including "ears"; width ¾ in.; thickness 3/16 in. on ridges; light-reddish chalcedony; beautifully channeled on both sides; channels taper to a thin sharp base; beautiful chipping; "ears" symmetrical; median basal notch. Microscopic chipping of the edges of this point most beautiful ever seen by the writer (also true of Fig. 22).

9. Atypical point complete; length 1 7/16 in. including "ears"; width ⅝ in.; thickness ⅛ in.; grayish quartzite; channels practically flat; chipping crude; edge dull; "ears" not symmetrical.

10. Folsom point (basal fragment); length 1⅛ in.; width ¾ in.; thickness 1/8 in. on ridges; mottled yellowish jasper; channeled both sides; one "ear" remaining.

11. Folsom point (tip, also broken at tip); length ⅝ in.; width ⅝ in., thickness 1/4 in. on ridges; smoky chalcedony; channeled on both sides; chipping neat.

12. Scraper; end retouched (end scraper); length 3 1/4 in.; width 1 1/16 in.; thickness ¾ in.; brownish-yellow jasper with blackish flecks; thumb fits slanting rear end; index finger fits on under side of concave edge; middle finger at right angle underneath; nice "feel."

13. Scraper; two sides retouched (side scraper), length 2 3/16 in.; width 1⅛ in.; blade 1/8 in. thick; butt ⅛ in. thick; yellowish jasper; top relatively flat; bottom concave; one lateral edge—one dorsal concavity, and one ventral groove and ridge fit the thumb and two fingers of the right hand.

14. Scraper (nodular); length 1⅛ in.; width ¾ in.; thickness 1/16 in.; yellow jasper; convex dorsally; flat ventrally; three-quarter retouching.

15. Scraper (nodular); length 1⅛ in.; width 1 1/4 in.; thickness 1/4 in.; yellowish to reddish brown jasper; convex dorsally, flattish ventrally, end scraper; beautiful chipping.

16. Folsom channel flake; length 1⅛ in.; width ⅝ in.; thickness 1/8 to 1/4 in.; flake from large point; brownish jasper.

17. Folsom point base; length 1 1/16 in. including "ears"; width ⅝ in. at widest point; thickness ⅛ in. on ridges; grayish flint; channel on both sides; chipping good; base thin, with slight central projection.

18. Folsom point complete; length 1⅛ in. including "ears"; width ⅝ in. at widest point; thickness ⅛ in. on ridges; smoky chalcedony; channeled on both sides; chipping relatively crude; base thick, chipped abruptly.

19. Folsom point base; length ⅝ in. including "ears"; width ½ in.; thickness 1/8 in. on ridges; whitish-mottled brownish-pinkish chalcedony; channeled on both sides; chipping good; base thick, chipped abruptly.

20. Folsom point tip; length ⅝ in.; width ⅝ in.; thickness ⅛ in. on ridges; yellowish-black mottled jasper; channeled on both faces; ridge more marked on one side.

21. Folsom point (fragment); length ⅝ in.; width ⅝ in.; thickness ⅛ in. on ridge; chocolate chalcedony; channel more pronounced on one side; chipping excellent.

22. Folsom point base; length 1⅛ in. including "ears"; width ¾ in. at widest point; thickness 1/8 in. on ridges; yellowish chalcedony; channeled on both sides; chipping very excellent; ears perfectly symmetrical; base gradually thinning, abrupt at edge. Beautiful piece.

23. Folsom point (fragment); length 1 1/16 in.; width ⅝ in.; thickness 1/4 in. on ridge; reddish mottled chalcedony; channel only on one side; chipping good.

Further work will be done on the Linger site. This will have to wait until the war is over and tires are once more available, as the trip is through trackless sand country and thorny vegetation and tires are severely punished. If the site proves extensive enough, camp will be established and the job done in a thorough manner.

Western State College of Colorado
Gunnison, Colorado
July, 1942

EVIDENCES OF EARLY MAN IN ALASKA

FRANK C. HIBBEN

EVER since the general acceptance of the theory that Bering Strait served as the entrance of man into North America, Alaska has been suggested as the most likely area for additional discoveries adding to our knowledge of Early Man. In spite of the fact that the bulk of these discoveries has occurred in the Southwest or in the far west of the United States proper, increasing attention has been paid to northern regions. The Folsom and also the Yuma problem (or problems as the case might be) have been traced into the northern Plains regions of Saskatchewan, Canada.[1] The belief that the Paleo-Indian entered North America across Bering Strait and moved thence up the Yukon Valley has been especially augmented by the discoveries announced by Collins[2] and Rainey.[3] These latter additions, it is true, belong to the Yuma category and the finds occurred under conditions indicating respectable antiquity. Even though the present status of investigations indicates that the Yuma complex is to be placed later than the Folsom, the Yuma question is still regarded as a facet of the Early Man problem. In the knowledge of the writer, no true Folsom point has ever been found within the boundaries of Alaska. This, in itself, does not preclude the possibility of Folsom Man having passed through Alaska, as types of flint working could easily have changed in a few centuries. There is indication that the specialized Folsom point and Folsom knife, the only really distinguishing features of the Folsom complex, may be a local development from some more generalized underlying hunting complex with accompanying tools. That some such underlying complex does exist is indicated by the discoveries at Sandia Cave[4] as well as by certain of the Texas discoveries.[5] In the present confused state of knowledge concerning the Yuma complex, types of cultures which might be expected in Alaska are even more obscure. In the light of these considerations it is imperative that actual sites along the supposed route of entrance of Early Man be located and, if possible, excavated so as to yield a maximum of information.

In an attempt to clarify a situation, which even in the Southwest is far from clear, the University of New Mexico, in the field session of 1941, undertook to explore as thoroughly as possible several crucial areas of Alaska where indications of Early Man might possibly occur. This was done partially by dead reckoning on a map, and partially by following up such leads as could be gathered from miners, traders, curio

[1] Bird, 1939. See Bibliography, pp. 291–295, following. [2] Collins, 1937.
[3] Rainey, 1939. [4] Hibben, 1941. [5] Roberts, 1940, pp. 73–80.

dealers, and from the work of Collins and Rainey already noted. Two areas were intensively studied. The area immediately to the north of Cook Inlet was examined as far inland as water and sporadic trails permitted, as was the area of the Lower Yukon in a hundred mile circle radiating out from the town of Koyukuk. In addition to the above two areas, some time was spent in examining the muck deposits exposed in the grounds of the Fairbanks Exploration Company in the vicinity of Fairbanks, Alaska, where discoveries of Yuma material have already been noted. Approximately three and a half months were spent on this total problem.

Of recent years, the greatest strides in studies of Early Man have been made by archaeologists and geologists in correlative studies of glacial stadia in direct relation to known sites of the Paleo-Indian. No studies of Early Man are now considered complete without correlative information concerning relationships with the last of the Continental Glaciations and the various sub-stages thereof. In the light of this, certain facts concerning Alaskan glacial history are prerequisites of studies of Early Man in this area.

The various extensions and lobes from the Continental ice centers of the last portion of the Pleistocene in North America never covered the central sector of Alaska. With the exception of the Brooks Range, the Alaska Range, and certain of the volcanic areas of the Aleutian Range, the northern portion of Alaska was ice free during the period known in the south as the Wisconsin.[6] The whole central Yukon sector, large portions of the Arctic coast, the Seward Peninsula area, and apparently sporadic bits on the coast near Cook Inlet, were not only ice free but also provided such essentials of plants, mammals, and surface features, as would be favorable for habitation.[7] Contrary to popular belief, from all available evidence climatic conditions in the Yukon Valley in the last portion of the Pleistocene were essentially the same as they are today. Most of the evidences for this statement have been derived from the so-called Alaskan muck. Studies of Early Man in Alaska are inevitably concerned with excavations in, and explanations of, the muck deposits of Alaska.

The deposits known as muck may be definitely described, in the opinion of the writer, as loess material. All characteristics seem to indicate a wind-borne origin from comparatively local sources, as the material resembles the underlying bedrock. The outwash plains of the local glaciations are likely points of origin for this material. These muck deposits are from four to one hundred feet thick and are especially well known in the vicinity of Fairbanks, Circle, and the other gold mining

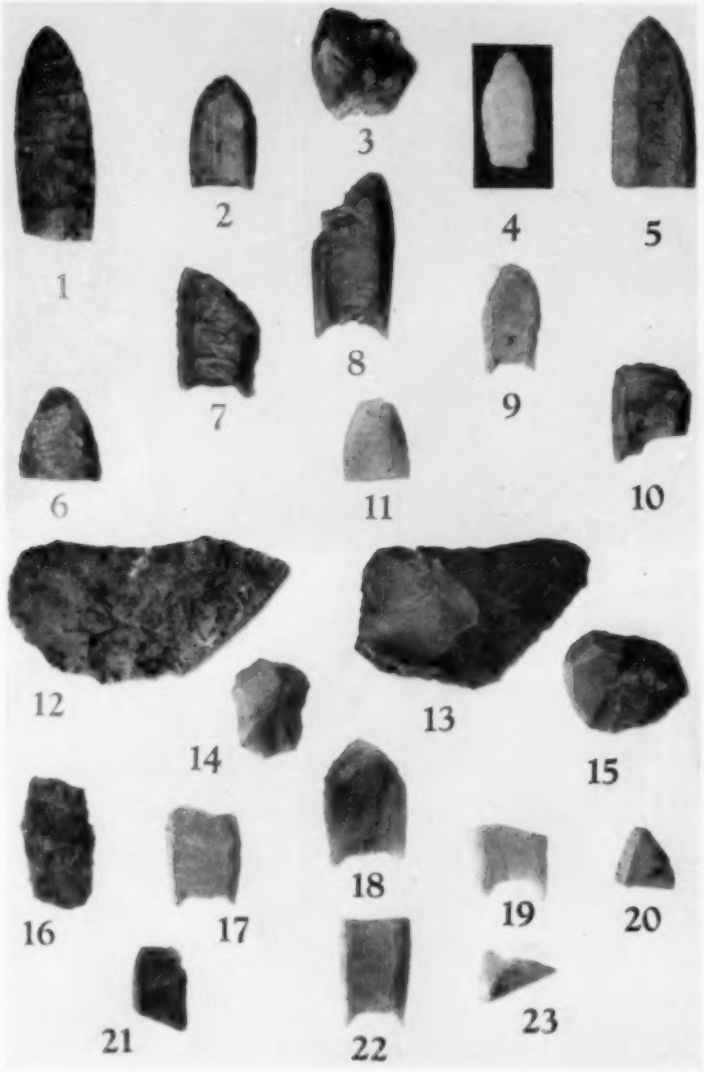
[6] MacClintock, 1937. [7] Smith, P. S., 1937.

centers of the upper Yukon and the Tanana where the muck overlies auriferous gravels. Muck deposits of considerable thickness, however, are found in the lower reaches of the Yukon, on the Koyukuk River, on the Kuskokwim, and on several places along the Arctic Coast, and so may be considered to extend in greater or lesser thickness, over all unglaciated areas of the northern peninsula. The deposits are concentrated in creek or river valleys for the most part, and have been exposed in gold mining operations. In addition to amorphous bodies of loess material, the muck contains inter-bedded volcanic ash layers, lenses of clear ice and peat, and abundant animal and vegetal material, the whole frozen into a solid mass.

Although the formation of the deposits of muck is not clear,[8] there is ample evidence that at least portions of this material were deposited under catastrophic conditions. Mammal remains are for the most part dismembered and disarticulated, even though some fragments yet retain, in this frozen state, portions of ligaments, skin, hair, and flesh. Twisted and torn trees are piled in splintered masses concentrated in what must be regarded as ephemeral canyons or arroyo cuts. However, areas in which peat layers occur indicate a stabilization of certain portions of the muck for at least a period of several years and forests of trees found in certain areas give evidence of even more lengthy periods of stabilization.[9] It thus appears that the formation of the Alaskan mucks is complex and that all of these depositions were certainly not made at a single time. This evidence is even more convincing when it is noted that at least four considerable layers of volcanic ash may be traced in these deposits, although they are extremely warped and distorted by solifluction. Insomuch as the remains of mammals upon whose existence the Paleo-Indian was dependent for food are an integral part of the muck deposits, it follows that the history of Early Man in these regions is also intimately bound up with these deposits and explainable only in terms of the same climatic conditions and factors which governed and finally destroyed the other mammal life. Mr. Otto Geist, through whose courtesy the author was allowed to examine the deposits in the vicinity of Fairbanks, has suggested that this mammal life was completely destroyed in one or a series of volcanic eruptions, and the loess material with the dismembered animal and vegetal remains, washed into the creek valleys from the surrounding hills where they were actually buried or later died.

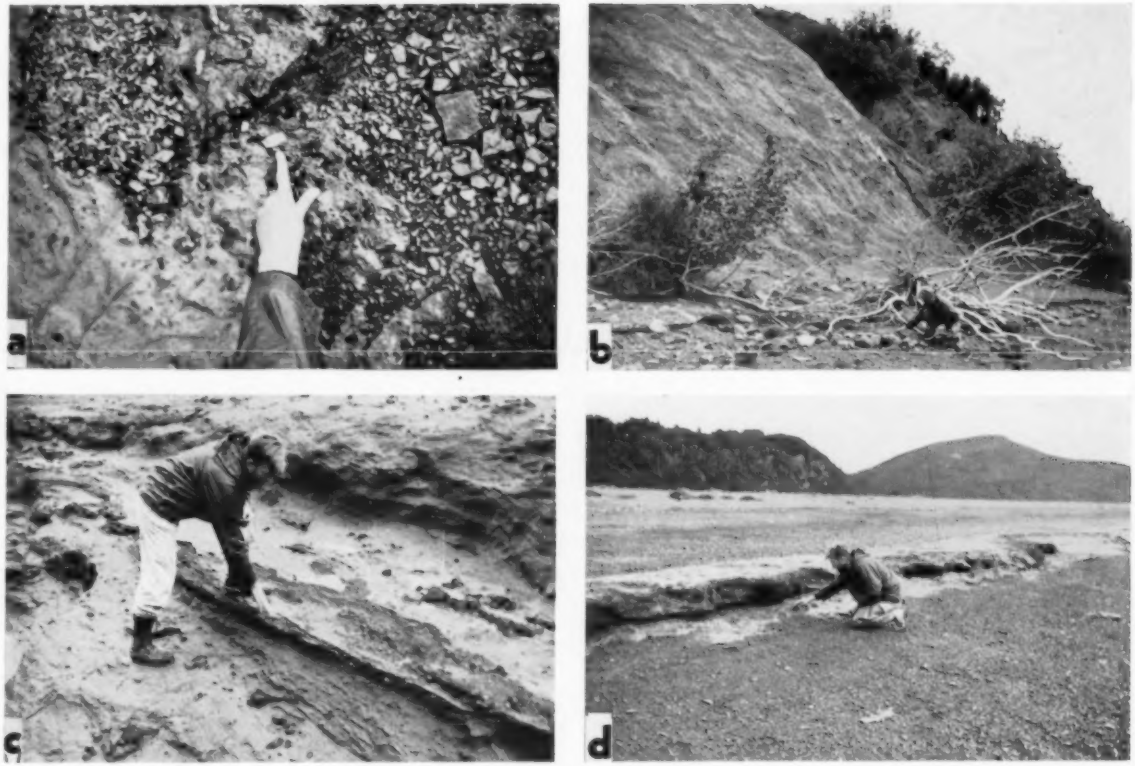
In light of the complex circumstances surrounding the deposition of the muck deposits in which the mammal remains are contained, it is probably not remarkable that no site of Early Man has been found

[8] Mertie, 1937, pp. 188, 189. Hibben, 1941. [9] Giddings, 1938.



(*Courtesy Southwestern Lore*)

Fluted Points and Associated Artifacts from the Linger Site, San Luis Valley, Colorado.



Chinitna Bay, Alaska. *a*, Folsom-like point in situ, a piece of wood is imbedded in soil above point; *b*, habitation level marked here by a stone strewn stratum below a bank of muck; *c*, a large log imbedded in the muck; and *d*, the peat stratum about the center of the site.

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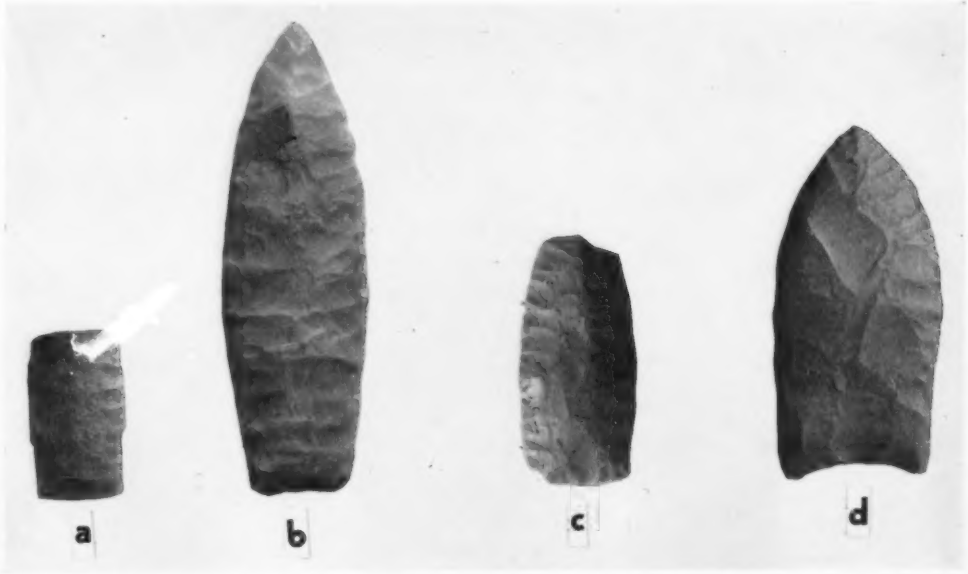
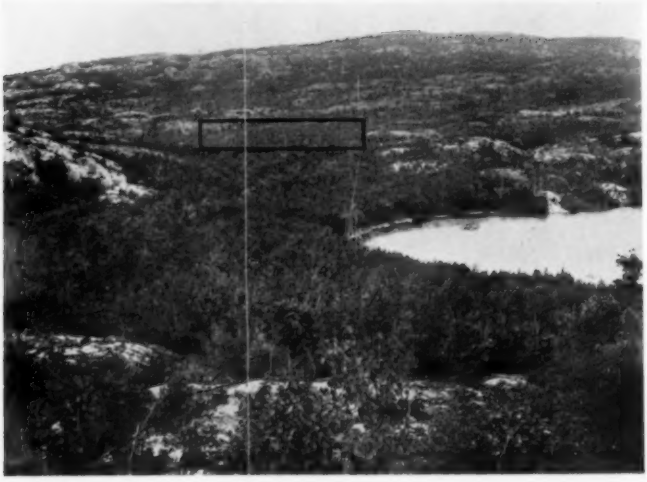
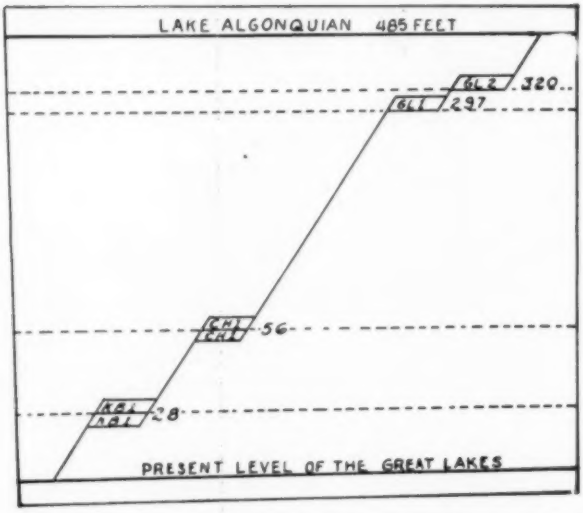


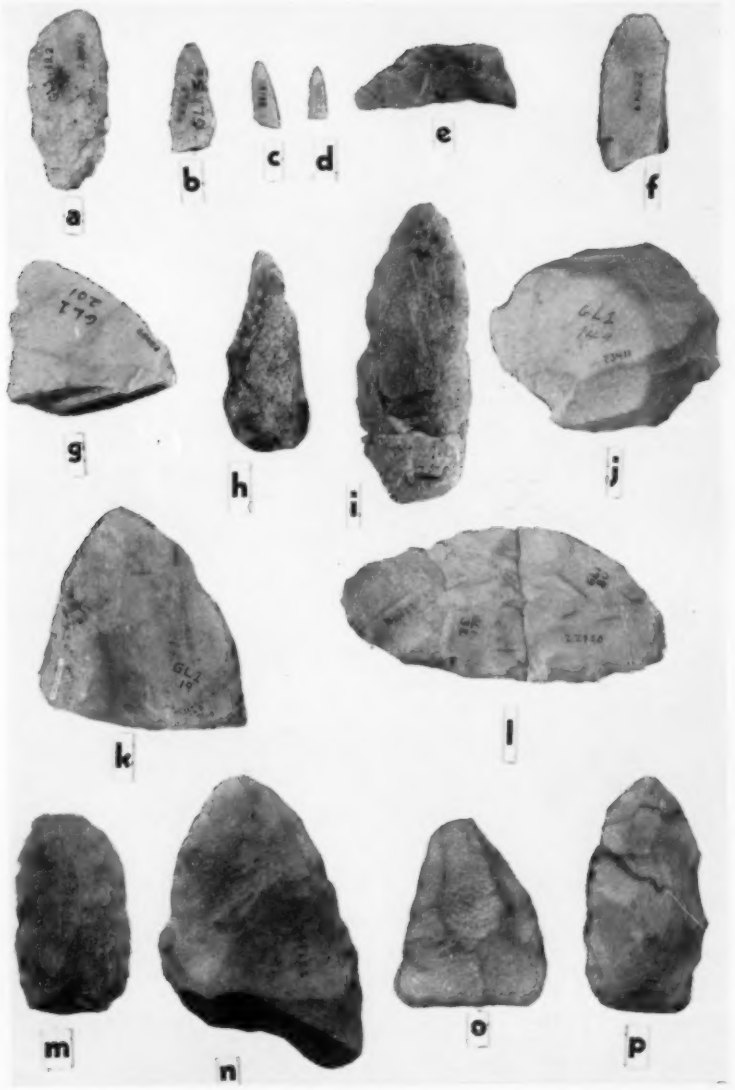
Artifacts from Alaska. *a*, broken Yuma point from muck deposits, Cripple Creek, Fairbanks; *b*, Yuma-like point found by a fisherman at Chinitna Bay; *c*, Yuma or Folsom-like point found in situ at Chinitna Bay site; and *d*, Folsom-like point found in the muck near Circle.





Above, Site GL1, Killarney, Ontario, looking northeast across the north end of Lake Lumsden. GL2 is to the left of the middle of the left side of the picture. *Below*, chart showing vertical relationships of four sites to each other and to the level of Lake Algonquin, and the present Great Lakes.

("Algonquian" is incorrectly spelled on the chart. Correct geological usage is "Algonquin.")



Artifacts from Killarney, Ontario. *a–d*, knives and/or perforators; *e*, fragment with secondary chipping; *f–g*, flake knives; *h–i*, light blades of chopper type; *j*, Levallois type tortoise-core; *k*, *o*, halves of semi-lunar scraper knives; *l*, semi-lunar scraper knife in two pieces found about twelve feet apart; *m*, rectanguloid scraper-knife; *n*, chopper; *p*, plano-convex blade, lighter than chopper type. (*a–i* slightly less than $\frac{1}{2}$ actual size; *j–p*, slightly less than $\frac{1}{4}$ actual size.)

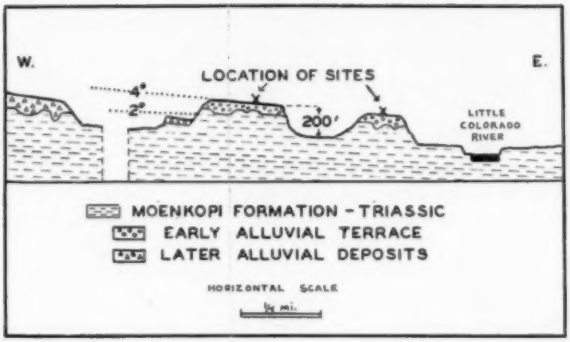


FIG. 22.—Cross-section of valley of the Little Colorado River, Arizona, near Black Falls showing the position of the early alluvial terrace upon which stone artifacts are found.

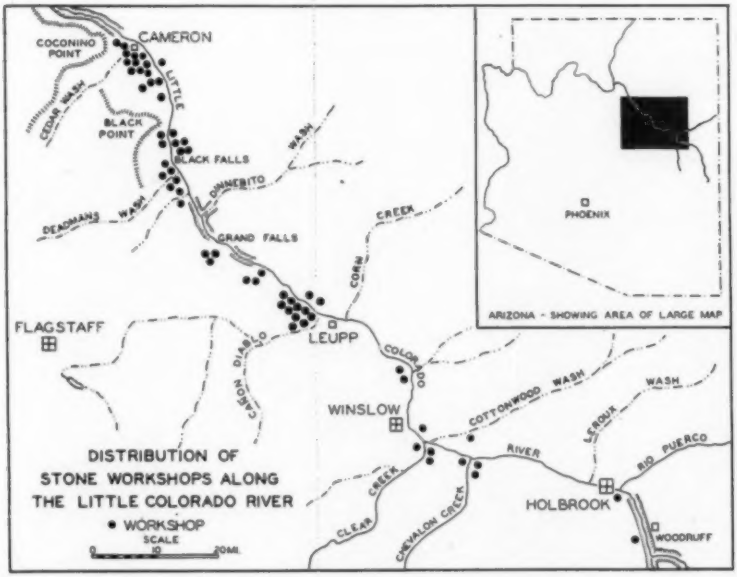
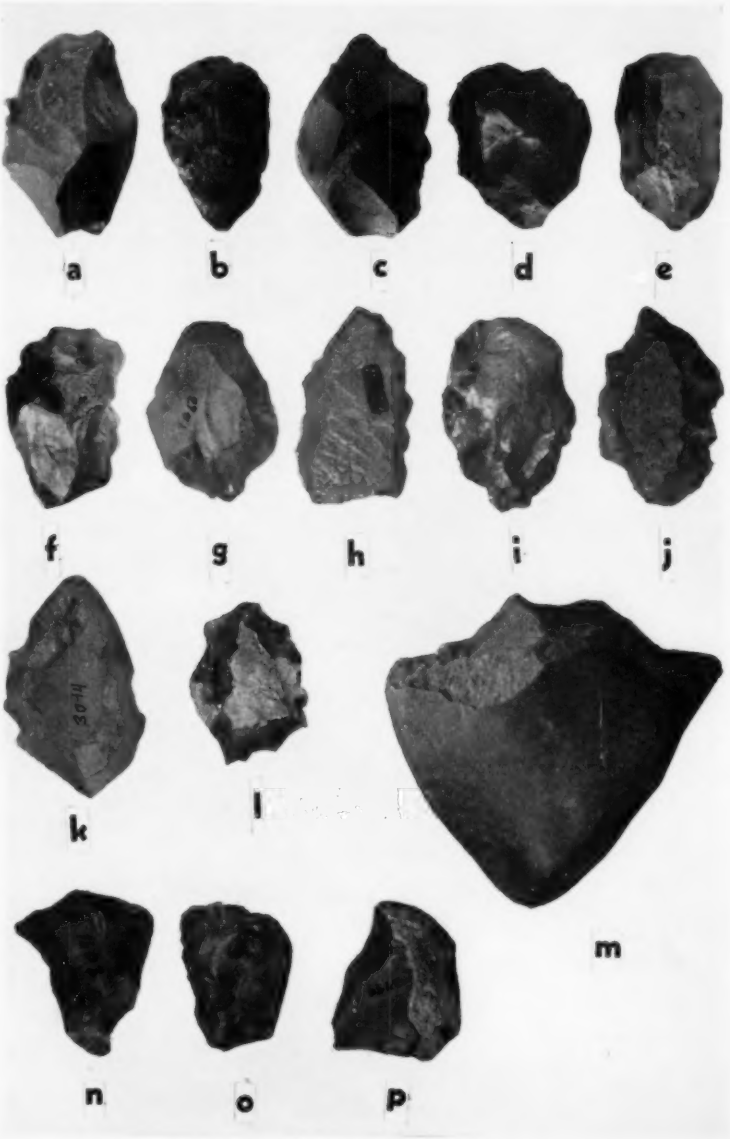


FIG. 23.



Artifacts from the Little Colorado Valley, Arizona. *a–f*, keel-shaped scrapers flaked by percussion from waterworn pebbles, utilized end at top (*a*, 76 mm. long); *g–l*, coup-de-poings, four retain a large amount of crust of original pebble (*h*, 82 mm. long); *m*, large keel-shaped scraper, removal of large flakes from a large pebble has made a satisfactory tool (110 mm. long); *n–o*, flakes used as scrapers, utilized edge at the left.

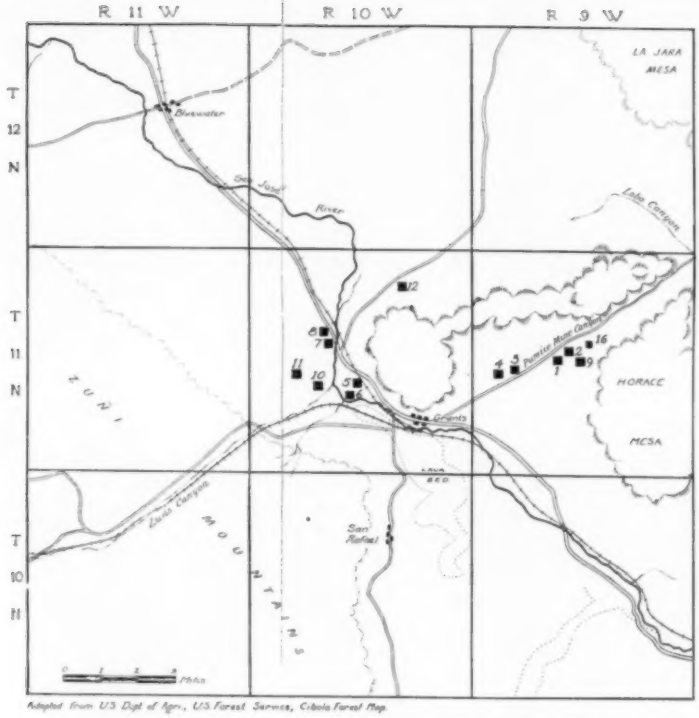


FIG. 24.—Location of non-ceramic sites near Grants, New Mexico.

within the body of these deposits. While assisting Mr. Geist to recover a particularly coveted portion of a lion mandible (*Felis atrox alaskansis*), the writer recovered the major portion of a Yuma point which was still frozen in situ on a newly sluiced portion of the muck floor at Cripple Creek near Fairbanks. This point (Pl. XV, *a*) may be definitely described as an Eden Yuma.[10] The chipping is fine and even and the shouldering at the base, in this case caused by grinding, is characteristic of this category. The material is a very fine dark red quartzite. The discovery of a Yuma point in this situation occasions no surprise, as Dr. Rainey has already recorded the presence of Yuma-like points in the mucks of this vicinity.[11] It is unfortunate that no habitation level or other evidence of a site could be discerned at this place. Apparently the point, even though still in a frozen portion of the muck, had been moved into this position along with the faunal and floral remains near it. It is significant to note that a large section of mammoth tusk was frozen into the muck and peat less than three feet from the point, as was the lion mandible mentioned previously.

In 1933, on a previous trip to Alaska, a point of very suggestive outline turned up in a curio store in Ketchikan (Pl. XV, *b*). Contrary to usual curio custom, the origin of this point was known. As was determined later, this particular point, which belongs to the Yuma category, was found with at least two others by Mr. Eagle Johnson of Seldovia, Alaska. These points were picked up by Mr. Johnson at Chinitna Bay on the north side of Cook Inlet. In the course of the last field season's reconnaissance, Chinitna Bay, as well as considerable portions to the east and west and inland, was examined. As the country is predominantly volcanic, and evidences of recent vulcanism are everywhere abundant, it was found extremely difficult to locate sites of even moderate antiquity. On the south and west side of Chinitna Bay, however, where frequent south-easterly storms are rapidly eroding the shore, a site was located at the same spot where the original three Yumas were found by Mr. Johnson.

The Chinitna Bay site extends along the western and southwestern side of the bay for roughly a mile and a half. Material is not exposed for all of this distance, nor are signs of habitation continuously visible. The most active wave cutting has taken place at the southeastern end of the extensive site near the mouth of a small unnamed creek. It was here that Johnson found the points as he was getting fresh water. Due to the wave cutting, the strata are visible and several square yards of habitation level have been laid bare. Occasional extremely high tides in

[10] Howard, Satterthwaite, and Bache, 1941; Howard, 1941. [11] Rainey, 1939.

this area coupled with strong southeasterly winds, are effective cutting agents many feet above normal high water mark.

The habitation level is marked by a dark colored stratum of humus, which immediately overlies a hard, compact, iron stained blue clay layer, which forms extensive portions of the beach along this side of the bay. Objects of human origin are, for the most part, scattered on the top of the blue clay after the humus has been washed away, or are actually found in the humus layer itself. One point (Pl. XV, *c;* Pl. XIV, *a*) was found in place in the humus layer, and chips were very numerous. Abundant chips of gray chert and of a mottled red and pearly gray chert, showed signs of working but could seldom be classified as implements. Chips were grouped in concentrations throughout the entire extent of the site, as though marking chipping areas. A few of these were elongated enough to have served as flake knives. Two might be classified as gravers. Most were nondescript. Charred wood was also sporadic throughout this extent, and was especially concentrated at the southeastern end, near the small creek. Bone material was not abundant, and only one species, the mammoth, could be identified by the few fragments recovered. The central and northern portions of the site, toward the head of the bay, showed no bone in the exposed areas at all.

Sporadic tree stumps marked the humus layer of the occupation level as these were being exposed. Roots and occasional whole stumps were upright and apparently in original growing position. Immediately superimposed on top of the humus and the occupation level, was a layer of muck, of loess-like consistency. The muck varied in thickness from four feet at the south end of the site near the creek mentioned before, to twenty-two feet near the center and north end (Pl. XIV, *b*). Here and there, this muck layer was shot through by lines and veins of iron stain. Near the top of the muck layer, a layer of volcanic ash 3 inches thick could be sporadically traced. The presence of volcanic ash here is to be expected, as the 10,000 foot still-smoking Mount Iliamna overlooks Chinitna Bay from the north. This muck stratum also contains sporadic logs and fragments of wood (Pl. XIV, *c*). The deposit was not frozen for as far back as was cleared for stratigraphic purposes (about two feet).

Superimposed as a capping on the muck layer was a considerable stratum of peat of apparently modern origin, which extended up to and including the grass roots and the peat layers of the present surface. This peat layer varied considerably in thickness, from one foot to six feet, and also was not visible throughout the entire length of the site.

Plate XIV, *d*, shows the peat layer cropping out on the beach at about the center of the Chinitna Bay site.

By following these various strata along the upper beach where they are exposed, it is evident that the habitation level throughout the mile and a half extent, if this can be considered all one site, rises and falls as though the site were originally on several low hills or knolls along the shore. The present high water line of the sea cuts first the blue clay layer below the habitation level and occasionally as high as the peat layer which is the uppermost of the series. It is entirely probable that land movements have taken place in connection with volcanic disturbances which would cause this shifting in land-sea relationship.

The placing of the Chinitna Bay site in the Yuma category still further complicates the Alaska picture. As may be seen by the accompanying illustrations, the Chinitna Bay points are similar to Yuma-like forms such as those recovered at Clovis,[12] and which may be regarded as contemporaneous with, and possibly affiliated with, Folsom. The single point (Pl. XV, *a*) recovered in the Fairbanks mucks is of a type, however, which is almost certainly later than Folsom. The position of the Chinitna Bay site *below* the muck and the Fairbanks points *in* the muck may be significant. Of possible interest is the point (Pl. XV, *d*) which was recovered from the mucks in the vicinity of Circle, Alaska, by Mr. W. C. Granger, a miner. It has also been suggested that even modern Eskimo points are remarkably Yuma-like in their characteristics.

University of New Mexico
Albuquerque, New Mexico
February, 1942

[12] Howard, 1935*a*.

AN EARLY INDUSTRY ON A RAISED BEACH NEAR KILLARNEY, ONTARIO

E. F. Greenman

IN THE summer of 1940, a site with an industry new to the region of the western Great Lakes was discovered near Killarney, Ontario, in the course of a survey of the Manitoulin District by the Museum of Anthropology, University of Michigan. Brief notices of this work have appeared in the press and in professional publications, and some of the readers of this paper have already seen the material. A more complete report than is possible in the present paper is in press.[1]

The site lies on a raised beach of Lake Huron, 297 feet above the present level of that lake, and about four miles inland, in the quartzite hills which form the southern border of the Laurentian Shield. It is two miles to the northeast of George Lake,[2] from which the field record symbol, GL1, is taken. The beach is some 800 feet north of a small lake known locally as Lake Lumsden, and eighty-nine feet above its surface. It is about 500 feet long east and west and 100 feet in width. The crest is less than five feet above the lowest ground to the north, i.e. on the back or landward side of the beach, and this lowest ground is within twenty feet of the crest. The implements and flakes found on and beneath the surface of this beach are judged to be contemporary with the waters of Lake Huron at that level, because many of them present a rolled or worn condition for which no other cause than wave action can be shown. It is the opinion of Dr. George M. Stanley that GL1 was occupied at a time when the edge of the retreating Wisconsin ice was within 100 miles to the north.[3]

When first examined, artifacts and flakes of quartzite were found on the surface of the beach from its crest down the forward slope, in a band about fifty feet wide and 350 feet long, the latter dimension comprising two-thirds of the eastern portion of the beach. Excavation revealed the cultural deposit as extending below the surface with an artifact zone about 1.5 feet thick. After two seasons of excavation no cultural stratification has been observed, although the larger implements and flakes are found chiefly from the surface to a depth of about 1.0 foot.

Construction, such as hearths, graves, refuse pits, or arrangements of stones, are lacking, and nothing of any material other than quartzite has been found. This material is available within 200 feet of any part

[1] Greenman and Stanley, N.D. See Bibliography, pp. 291–295, following.

[2] Canada Department of Mines and Resources, Geological Survey, Map 220 A, —"Panache Sheet."

[3] Greenman, and Stanley, N.D.

of the beach, and consequently the site may be described as a quarry-workshop, and it appears to be, in addition, a village site.

The industry represented is mainly characterized by implements of considerable size, and simplicity in stone working technique. No grinding processes were used, and notched and stemmed points have not been found. The implement types come under the terms scraper-knife, chopper and perforator, terms which cover some variety in size and shape.

The most numerous implement is the scraper-knife with a semi-lunar outline, ranging in length from 11 to 18 cm. One complete specimen is shown (Pl. XVII, *l*) and halves of two others (Pl. XVII, *k*, *o*). These are bifacial, some plano-convex, others not. One long edge is more deeply curved than the other, and one end is usually more pointed than the other. The range in thickness is from 15 mm to 3 cm, with the average thickness closer to the latter figure. The specimen shown at *a*, Plate XVII, is much shorter than the semi-lunar knives, and cannot be included in that class, but its close resemblance in outline to *l*, Plate XVII, is of interest. The cross section is oval. There is another of about the same size and somewhat similar outline, with a plano-convex cross-section. Another type of scraper-knife is that with a rectanguloid outline (Pl. XVII, *m*). There are thirteen specimens of this type, and one end of eight of them is a thick face resembling a broken end.

Choppers are thick, heavy forms of the "hand ax" type, pointed at one end and rounded or straight at the other. The base of the specimen illustrated (Pl. XVII, *n*) is either broken off or the specimen is complete as it is. The range in length of these implements is from 11 to 19 cm. A single one has a plano-convex cross section, one face being a single flake surface. Cross sections of the rest are roughly oval.

Allied to these choppers in outline are several blades, lighter in weight, thinner, and with the length in a larger proportion to the width (Pl. XVII, *h*, *i*, *p*). These range in length from 8.5 to 14 cm. Plate XVII, *p*, is the only one in this sub-class having a plano-convex cross section. The face opposite that shown is an unworked fracture plane. One specimen of this type is elliptical in outline, pointed at both ends, with the widest portion at one side of the center.

Two small perforators have the appearance of fragments of the point portions of flint drills of the type common on later sites in northern North America, except that they are thinner (Pl. XVII, *c*, *d*). The longer of the two appears to have been made by pressure flaking which operated on all surfaces. The cross section is elliptical. The shorter one has a plano-convex cross section with three faces, only one of which

has been retouched. This specimen, and possibly the other, was evidently made from a small sliver of quartzite which had something of the desired proportions to begin with. There is another specimen of this general type (Pl. XVII, *b*), twice the dimensions of the larger of the other two, with an angularly elliptical cross section. In addition to perforating, it could have served as a small knife. It is coarsely flaked on both faces. The end opposite the point of all three of these implements is a fracture surface. There is nothing to indicate that there were finished bases which have broken off.

In addition to the foregoing, which are core implements for the most part, there are three flakes, one edge of each of which has been chipped, either intentionally or as the result of use. Two are triangular in outline (Pl. XVII, *g*), and one rectangular (Pl. XVII, *f*). The two triangular specimens, with perpendiculars of about 7 cm, are not blunted-back knives, although each has one sharp unflaked edge. Both are single flakes, with platform and bulb.

There is one badly waterworn specimen which may be a scraper-graver of the type reported by Roberts[4] from the Lindenmeier site in Colorado. If so, a centimeter or more of the point has been worn or broken off, and the flake-scars of the end-scraper portion have been made indistinct.

Two cores have been collected, one of which is shown in *j*, Plate XVII. This has all the appearance of a true Levallois core excepting in its lack of a percussion scar where the central flake (on the face shown) was detached. The specimen is much worn on all faces and edges, and the scar may have been obliterated, although there is a scar on the opposite face caused by the blow which detached the entire piece from a larger block of quartzite.

Several thousand flakes have been collected. Most of them are squamous in proportions, and the average outline dimensions are about 4 cm long and wide. They were probably detached by indirect percussion. Platforms are very small, and mostly faceted. Outer surfaces are in most instances faceted as the result of previous flaking. In all but ten or fifteen instances the angle of the platform to the main flake surface is from 90 degrees to 100 degrees. On the remainder, which are two to three times larger, this angle is higher, ranging from 110 degrees to 122 degrees. These platforms are all unfaceted, as is the case for the Levallois core, which has the platform set at an angle of 135 degrees to the main flake surface.

Many of the implements are much worn, and proof of their contemporaneity with the waters of Lake Huron at a level of 297 feet above

[4] Roberts, 1935.

the present level rests, in the final analysis, upon that fact. That this abrasion is not the result of use is indicated by the fact that some of the flakes are worn, as is also the tortoise-core of Levallois type (Pl. XVII, *j*), Further, one-half of a semi-lunar blade is worn not only over all faces and edges, but over the edges of the broken end (the lower end in Plate XVII, *o*). There seems to be no possibility of erosion or leeching of a chemical nature.[5] The worn condition is not distributed alike on all specimens. It is not limited to working edges or points, and is sometimes present on one side and absent on the other.

Many of the specimens show a patina or discoloration on the surface and to a depth of apparently not more than 5 mm. The color is brown in various shades, and is evidently derived from the coarse sands of the beach, which a foot below the surface are reddish brown. The finer material of the uppermost foot of the beach is pure white, and clay-like in texture, a circumstance the meaning of which is somewhat obscure and remains to be interpreted.

Most of the specimens, including many flakes, are glazed in small areas. This is at present interpreted as the result of abrasion due to minute movements of the beach in freezing and thawing, and from soil flow and vegetational activities, over a long period of time. The glaze is the same in character as that found on the working edges of some flint hoes in the United States and elsewhere, but on these specimens from GL1 it is not limited to edges or points, where it may be entirely absent though present in the middle of one or both faces of the same specimen. Implements which may be regarded as unfinished are also glazed. One such is a "blank" of a semi-lunar blade 11.3 cm long. The probability that it is unfinished is increased by the fact that two of the flakes struck off in making it were found within ten feet.

During the summer of 1941, another site was discovered within half a mile to the west of GL1, on a small beach at an elevation of about 320 feet above Lake Huron. Like GL1, this site (GL2) is on a slope which descends to Lake Lumsden, from the shore of which it is about twice as far as GL1 is from the same lake. A few specimens were collected at GL2 from a hillock caused by a falling tree, and the industry represented is the same as that at GL1. GL1 is eighty-nine feet, and GL2 is 112 feet above Lake Lumsden, and the slope between the two sites and the edge of the lake is cut by gullies fifteen or twenty feet deep, and by many small distributaries in the lower sandy portions. Between both sites and the shore of Lake Lumsden a few flakes, and two artifacts, have been found on the surface. All the evidence which has turned up so far points to surface drainage as the cause of this condition. The volume of

[5] Greenman and Stanley, N.D.

water coming down these slopes during the spring freshets, and after heavy rains in summer, is very considerable, and there is little doubt that much material between the actual sites and the lake, and at approximately the same level of GL1 at least, has been carried into the lake since their occupation. The outlet of the small lake, at the south end, is so low that there is no possibility that its waters ever reached either site.

The relationships of these two sites seem to be chiefly with two others in eastern Canada, one at Tadoussac, Quebec,[6] and another near Hopedale, Labrador.[7] Roughly-flaked blades of quartzite and other materials, with semi-lunar outlines are found at both localities. Dr. George Lechler of Wayne University, Detroit, with many years of experience in the north European field, believes that the industry represented at GL1 and GL2 is mesolithic in the type of flaking because of the lack of fine secondary chipping on most of the specimens, and the formation of an edge in some instances by the detachment of a single large flake from one face at a low angle to the opposite face. He is of the opinion also that the two small perforators in Plate XVII, *c*, *d*, are good microlithic types.[8] Relatively fine retouching of edges is not, however, absent from this industry at Killarney. Very shallow, long narrow flakes were removed from the slanting portion of the fragment of an implement from GL2, shown in Plate XVII, *e*, and two portions of semi-lunar blades from GL1, much thinner than the rest, have relatively small flake scars on both faces, and are retouched on the edges. A further point bearing upon the question of mesolithic technique is the degree of completion of the larger specimens, Some are obviously "blanks." It is conceivable, though unlikely, that most of them are. Nevertheless, the suggestion of Dr. Lechler is a valuable one. In this connection, it is worth while to call attention to the resemblance between the small stemmed points from the Windy Tickle site in Labrador[9] and Swiderian types from Poland.[10] The Windy Tickle site, nearly a thousand miles north of GL1, would presumably have been occupied at a later time than GL1, if, as is the opinion of Dr. Stanley, the ice sheet was within 100 miles of GL1 at the time of its occupation.[11]

At the present time there are four sites in process of excavation at Killarney, three of them so connected with raised beaches of the Great Lakes as to be datable by geological means, and it is probable that the fourth (GL2) will be found to have been contemporary at least with the

[6] Wintemberg, N.D. [7] Strong, 1930.
[8] See for example Zotz, 1932, Abb. 1, No. 10; Childe, 1939, Figs. 3, 4.
[9] Strong, 1930, Pl. 4, *n*, *o*, *r*. [10] Childe, 1939, Fig. 1, *2*, *4*, *6*.
[11] Greenman and Stanley, N.D.

GL1 level, if not with its own. Two of these sites,[12] and another on Great Cloche Island, twenty-seven miles west of Killarney,[13] have already been reported. The vertical relationships of the four sites near Killarney are shown in the chart (Pl. XVI). KB1 is a Woodland site, with two components, one water-laid, the upper one in the top soil. CH1, at an elevation of fifty-six feet, is non-ceramic, with two components. GL1 and GL2 are described in the present paper. The level of Lake Algonquin, the last of the glacial Great Lakes, is shown for the vicinity of Killarney at the top of the chart. Owing to the upward tilting of the land north of Saginaw Bay, the waters of the Great Lakes receded, and at three of the levels shown in the chart, and probably at all four, there was human occupation when they were at the waters' edge. From the Lake Algonquin level the water dropped gradually some three or four hundred feet,[14] then rose to the stage of the Nipissing Great Lakes which at Killarney is at an elevation of about eighty-five feet. From there, after a stand of some centuries, it receded again to the present level, about 580 feet above sea-level. During these changes the site CH1 was awash three times. This site, about two miles from GL1, and four miles from KB1, has a lower water-laid component in which so far the use of no other materials than quartzite and slate has been demonstrated. It is possible that the site was occupied when Lake Huron was receding from the Lake Algonquin stage, and that the industry of the site is an evolved GL1 industry. There is one fragment which resembles an end of a semi-lunar blade. The (stratigraphically) upper component contains artifacts of flint, quartzite and slate, and to all appearances was the result of an occupation while the Lakes were receding from the level of the Nipissing Great Lakes.

University Museums
Ann Arbor, Michigan
June, 1942

[12] Greenman and Stanley, 1941. This is a report on KB1 and CH1.
[13] Greenman and Stanley, 1940.
[14] Greenman and Stanley, N.D.

A PRIMITIVE STONE INDUSTRY OF THE LITTLE COLORADO VALLEY, ARIZONA[1]

KATHARINE BARTLETT

ABOUT eight years ago there was discovered in the valley of the Little Colorado River between Holbrook and Cameron in northern Arizona, evidence of an ancient alluvial terrace.[2] Sand and waterworn pebbles largely derived from the Triassic Shinarump Conglomerate that once covered the area, form the deposit. The terrace which was formed by the gravels is now much dissected and remains only as the isolated flat tops of hills and ridges, the surfaces of which are covered with a desert pavement of waterworn pebbles. There are remnants also of later and lower alluvial deposits containing angular fragments of rock, of which a large proportion is made up of basaltic rocks from the San Francisco Peaks (Fig. 22).

In many places upon the desert pavement of the alluvial terrace are very crude implements roughly flaked from the pebbles, testimony of man's work at some time in the unknown past, when the pavements served as "quarries." The primitive culture represented is called the Tolchaco focus. Sites, i.e. places where the implements occur, are not found everywhere on the gravels, but usually on the tops of the higher hills and on the ends of ridges, as if the ancient artisans wished to survey the surrounding country as they worked. Within a mile of the Little Colorado River, sites can be found on every hill and ridge between Holbrook and Cameron. Some seventy sites have now been located, as indicated on the map (Fig. 23).

At some sites, worked pebbles and flakes sparsely cover areas several acres in extent, while at others, scattered implements appear in areas only a few yards square. The most characteristic features of these "quarry" sites are the extreme sparseness of the implements and the wide areas over which they may be found. The latter is, without question, due to the fact that surface pebbles were used, and when a suitable one was found, an implement was made of it on the spot.

The implements are made mostly from quartzite, chert pebbles, and agatized wood. They are rather small, being limited by the size of the available pebbles. All are roughly flaked by percussion, and some show retouched edges. The most characteristic tools are biface, but there are

[1] Reprinted with permission from *The Plateau*, Museum of Northern Arizona, Vol. 14, No. 3, January, 1942, with some corrections and additional illustrations.

[2] Reiche, 1937. This is the only paper yet published on the recent geology of the Little Colorado River.

hundreds of utilized and utilizable flakes. Most of the flakes are small, of miscellaneous shapes, and 80% still retain some of the crust of the original pebble. Eighty-five per cent or more show no evidence of striking platforms and no well developed bulbs of percussion. This seems to indicate an industry principally composed of biface implements in which flakes, struck off in the making of the biface tools, were utilized.

The most typical implements are of two sorts. The first is a keel-shaped scraper or planing tool (Pl. XVIII, *a–f*). A round pebble made flat on the under side by the removal of a number of flakes, or a naturally split pebble with a flat surface was used. The upper side is high, somewhat keel-shaped, and the working edge may be squared, rounded, or pointed. The second type is a crude sort of tool like a European coup-de-poing or hand ax (Pl. XVIII, *g–l*), roughly flaked on both sides and with an unevenly flaked edge. Other forms are hammerstones, choppers, large scrapers (Pl. XVIII, *m*), and a great number of small scrapers made from flakes (Pl. XVIII, *n–p*), which could be used as single or double side scrapers, end scrapers, circular scrapers, blades on flakes, and drills. None of the implements show patination, which is characteristic of the most ancient stone industries throughout the world.

One feature of this industry is the great scarcity of bifacial points, whether knives or dart points, and the total lack of arrow points. A few large bifacial blades have been found, which are crudely flaked by percussion, and in technique resemble the other bifacial implements. On seventy sites, only three possible dart points have appeared; they are finely made and retouched all over, and probably do not belong to this culture. Not even a fragment of an arrow point has been found.

At the present time, no relationship between the age of the alluvial deposit and the age of the stone implements has been determined. At several places along the Little Colorado River, namely Holbrook, Winslow, Leupp, and Cameron, there are large gravel pits in the alluvial deposit where road material has been removed. These extensive cuts have been carefully searched in the hope of finding implements in place below the surface, but to date not the slightest evidence of this sort has been found. The alluvium was deposited at some remote time in the past, probably in the Pleistocene period, and at some time between then and the present, people, of whom we know very little, used the desert pavement on tops of the hills as a source of material for their implements. The implements are confined to the surface and widely scattered thereon.

No bones, fossil or recent, have been found with the implements, and there is no indication of hearths or camp sites. No grinding stones have been discovered. Single potsherds have been gathered at a few of the

sites, but single sherds are not significant in a country that once bore a dense Pueblo population.

On the gravel hills, no Basketmaker or Pueblo dwellings have been located, although evidences of these structures are found closer to the river on the river flats. Bifacial implements like the hand ax and planing tool, found on the Tolchaco terrace, do not appear in our collections of Basketmaker-Pueblo artifacts, although flake scrapers and blades are common. Furthermore, as previously mentioned, no arrow points, which are distinctly Pueblo, are found on the terrace sites. No sites away from the gravel terraces have yet been located where similar implements can be found, though the country has been searched diligently with this end in view.

In technique, the stone industry of the Little Colorado Valley seems to resemble the Lower Palaeolithic of Europe, in the kinds and shapes of bifacial implements, the utilization of flakes struck off in the preparation of the former, and the evident lack of prepared striking platforms. The flakes appear to have been removed in a haphazard manner, the bulbs of percussion are small and not well developed, and the flakes are of miscellaneous shapes. Anthropologists who have seen the material agree that these are certainly man-made implements, but that they represent one of the crudest stone cultures yet known in the Southwest.

Therefore, because the technique of manufacture of the Little Colorado stone implements of the Tolchaco focus is very crude, because no blades, dart or arrow points have been found, and because the implements are in no way associated with the pottery-making cultures which date from about 500 A.D., we are inclined to believe that the stage of culture represented antedates the Basketmaker-Pueblo culture in this area. Since the stone implements are found entirely upon the surface, and unrelated to any dated cultural material, we cannot yet determine how much older than Basketmaker they may be.

Museum of Northern Arizona
Flagstaff, Arizona
May, 1942

THE SAN JOSÉ NON-CERAMIC CULTURE AND ITS RELATION TO A PUEBLOAN CULTURE IN NEW MEXICO

KIRK BRYAN and JOSEPH H. TOULOUSE, JR.

THE archaeology of the Puebloan or Anasazi people of the Southwest has been the subject of many investigations, to the neglect of partly contemporaneous peoples of different cultural background. However, the existence of a non-agricultural people as predecessors and contemporaries of the Puebloans has been postulated on general, theoretical grounds. It comes, therefore, with something of an expected surprise to realize that in the heart of the Puebloan area of central New Mexico at least one non-ceramic cultural complex existed. The present investigation gives only faint clues to the antiquity of this complex and to possible relations of the people represented by these artifacts with the Puebloans. A later and derivative Lobo complex is associated with Pueblo I and Pueblo II pottery and represents a close association or perhaps a fusion of a hunting people with the Puebloans. The present paper deals with the location of the sites, the artifacts found in them, and the general archaeology. The following paper, by Bryan and McCann, describes the local geology and makes a geological and archaeological correlation with other areas in the Southwest. The two papers should be regarded as a mere introduction to a field of archaeological research that has heretofore been much neglected.

The stone cultures here described occur in blowouts where modern winds are excavating low dunes or heaps of sand piled up by the winds of the past. In all, twelve sites[1] have been found in the vicinity of Grants, New Mexico (Fig. 24). In 1939, Bryan visited the sites with Toulouse, and in 1940 he returned with Mr. Franklin T. McCann for a study of the geologic relations. The study of the artifacts is largely the work of Toulouse; the text is largely the work of Bryan.

The modern town of Grants lies at the foot of mesas extending south from Mount Taylor, a volcanic pile that rises to over 10,000 feet. The

[1] The first site was found by John M. Goggin who induced Toulouse to visit Grants in the fall of 1937. In 1938, a total of eight localities was found by Toulouse, and investigations were carried on for a period of several weeks. Brief visits to the area were made, and additional sites found in 1939, 1940, and 1941. The work of 1938 was part of a survey for the Laboratory of Anthropology of Santa Fe, New Mexico, where the materials are deposited. The staff of this institution, H. P. Mera, W. S. Stallings, Jr., and Stanley Stubbs gave helpful suggestions. The late Professor Glover Allen generously identified the bones collected. John M. Goggins, H. Myers, C. Bloom, D. Osborne, A. Rogers, G. Rogers, W. Hurt, Jr., and E. Blumenthal assisted in the field or donated specimens collected.

town occupies the former site of the ranch of Don Diego Antonio Chavez, called Los Alamitos. Here there is a spring mentioned in early accounts of the area. To the southwest lie the timber-covered Zuñi Mountains, and to the southeast, broad and intricately carved mesas. The Rio San José rises on the Continental Divide to the west, and runs eastward to the Rio Puerco (of the east) through a broad valley that forms a natural passageway between these highlands. The Santa Fe railroad and the modern U. S. Highway 66 utilize the valley of the San José. As a passageway for primitive people, the San José valley is a somewhat better highway than it appears at first sight. Four lava flows invade the valley and give to parts of it a formidable and depressing appearance. However, these lava flows restrict the flow of flood waters and bring the ground water to the surface as springs. Thus, the valley has rainwater pools, broad meadows, and permanent springs. In it live most of the Acoma Indians enticed from the isolated rock on which they lived when the Spaniards first came. Here, also, are the numerous villages of the post-Spanish pueblo of Laguna. The vicinity of Grants is notable because trails lead eastward to these pueblos and thence to the Rio Grande, south to the high basaltic plains north of the Datils where antelope still roam, southeast to Zuñi and west to Hopiland and the Navaho country, and northwest and north to the springs on the western flank of Mt. Taylor and to the extensive plateaus of the San Juan area. It is, therefore, a natural crossroad for a primitive people dependent on hunting, and in contact, by trade or war, with settled agriculturists such as the early Anasazi or Puebloan peoples.

The location of the important sites is shown on the accompanying map (Fig. 24). All these sites are within four miles of the spring at Grants. The site known as Grants 9 is also only a mile from the natural lake in Sec. 21, T. 11 N., R. 9 W., which holds water after rains.

In general location and in the details of location, the sites are suitable as camps of a hunting people. It is recognized that most hunting people follow a more or less definite circuit which is completed in a period of time, usually a year, but for some groups or individuals a longer period.[2] They "follow the game," hunting those animals that are easiest to obtain, or those that are in prime flesh for each season, in definite moves from known locality to known locality. The hunters know from experience that a given locality will support for a period so many people and no more, furnishing about so many necessary pelts or so much wild fruit as an accessory food. The animals which furnish special products needed by the group are hunted at some special place at some convenient interval of time. Family groups usually move to-

[2] Ekblaw, 1927–1928. See Bibliography, pp. 291–295, following.

gether and, balancing the advantages of one locality against another or bound by tribal law, choose the locality best suited to the exigencies of the particular occasion. Within the locality there are also favorite camping places reoccupied time after time, places easy of access, that afford access to the objective as well as water, wood, shade, or well-drained ground. The Grants locality with its springs and its focus of routes has the advantages which have been mentioned. The choice within this locality of sand dunes as sites for camps seems to testify to a desire for easily drained ground and leads to the inference that the camps may have been occupied during rainy weather.

As shown hereafter, the earliest people to occupy these sites had no pottery. They are, therefore, according to generally current opinion, assumed to have had no agriculture. However, this assumption although convenient and presumably correct, may be in error. It will be recalled that the people of the Basketmaker II stage lacked fired pottery, but practiced agriculture. The large volume of camp refuse, the existence of stone artifacts made from local materials, and the scraps of bones of food animals combine to indicate that the sites were occupied for periods of days or weeks rather than as overnight stops. Stays of such length seem to be required, particularly for the production of locally made implements.

The later people who occupied these sites were associates and contemporaries of pottery-using Pueblo I people. Their motives in camping on the dunes may have been more complex. It is more likely, in the relative complexity of social life of this period, that they were merely parties of travelers, camping overnight at this focus of routes. Furthermore, they may have had flood-water fields planted in the broad alluvial flats or they may have cultivated fields in the sand dunes, occupying the camps while planting or harvesting. It is also possible to postulate that Pueblo and hunting peoples met in this place as neutral ground for trading purposes. Obviously the existing evidence is inadequate to provide data on which to form a judgment on the complex relationships which may have existed at a time when the social organization was as highly perfected as in Pueblo time.

THE STONE COMPLEXES

Two groups of artifacts were found in the sites near Grants. The earlier complex without pottery, is called the San José, the younger, associated with pottery, is called the Lobo. The name San José is given to a complex of stone implements consisting of serrated[3] projectile points, drills, knives, scrapers, and grinding tools.

[3] "Serrated" is a term also used for implements characterized by regularly spaced notches chipped out of a previously prepared smooth edge. The serrated edge of this type

As shown in Plate XIX, *w–h'*, the points are strongly serrate and range in length from one and a half to two inches. They have a broad tang with an indented base. The edges of the tang are smoothed by grinding.

Associated with these points are hearths, less numerous projectile points of slightly different aspect (Pl. XX, *e–h*, Pl. XXI, *a–c*), leaf-shaped points which are common in the later complex [in Pl. XXII, points *b* and *f* are San José, points *a* and *c* are Lobo, and points *d* and *e* are indeterminate] and utilized flakes, many of which show secondary chipping. The leaf-shaped knives (Pl. XXII, *g–k*) are partly San José and partly Lobo; they are indistinguishable from each other. Drills (Pl. XXI, *f–k*) and several types of scrapers, end and side (Pl. XXIII, *c*), snub-nosed (Pl. XXIV, *a–f*), side (Pl. XXIII, *d–f*), and concave (Pl. XXI, *l–n*) also occur. Choppers are common but are not unlike those reported from late Pueblo sites.[4] The grinding implements are the small, portable, oval-bowl metate, made from an unshaped slab of sandstone, and a small, round mano, mostly shaped by pecking. Some of the mano facets are flat and seem to indicate use of the mano in a direct back and forth stroke along the major axis of the metate. Others have a curved facet and appear to have been used with a rocker or rolling motion of the mano.

Included in the collection are projectile points of which four are illustrated in Plate XX, *e–h*. These points lack the serrated edge, and have a regularity in their pressure flaking reminiscent of the Yuma. They have straight or rounded bases, and some have shapes which have been regarded as characteristic of the Yuma complex. Obviously they are not the Yuma of the Eden Site in Wyoming,[5] but in the present state of our knowledge they might be regarded as a late and somewhat degenerate type. It is not clear whether these points should be regarded as a normal component of the San José complex or not. They may have been collected by the San José people as antiques, or introduced by contemporary but different people. As, however, they form a small proportion of the whole number of projectile points collected (four as compared to twenty-two San José points at Site 6), it seems that, until the

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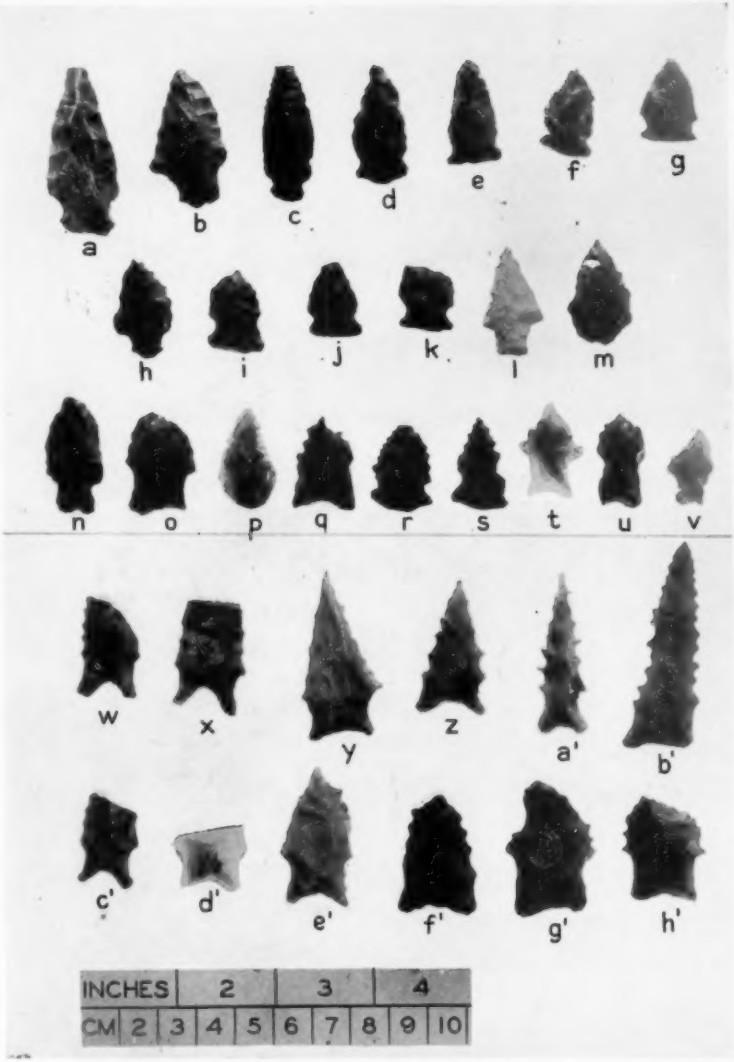
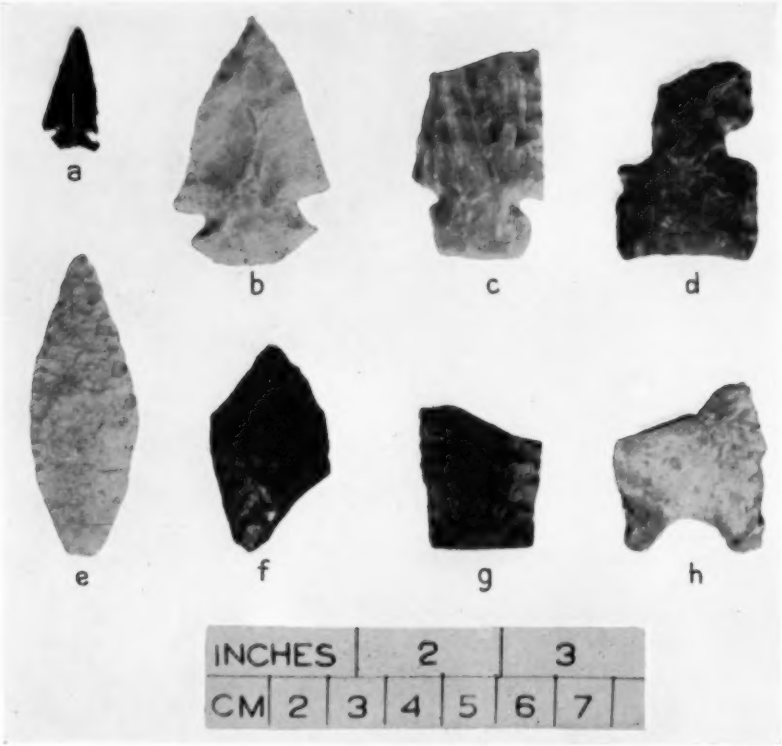
could easily have been used as a saw or for engraving a series of parallel grooves. As this edge occurs on scrapers its use in industry seems probable. The serrated points here considered have an edge consisting of more or less regularly spaced denticles formed as an inherent feature of the final retouch of the edge. Serrated projectile points having edges of this type are common in collections from the Great Plains of Texas and elsewhere. The purpose of the serrations is unknown, but they may have served either as an aid to penetration of the projectile or as a means of holding the projectile in the wound.

[4] Toulouse, 1941.

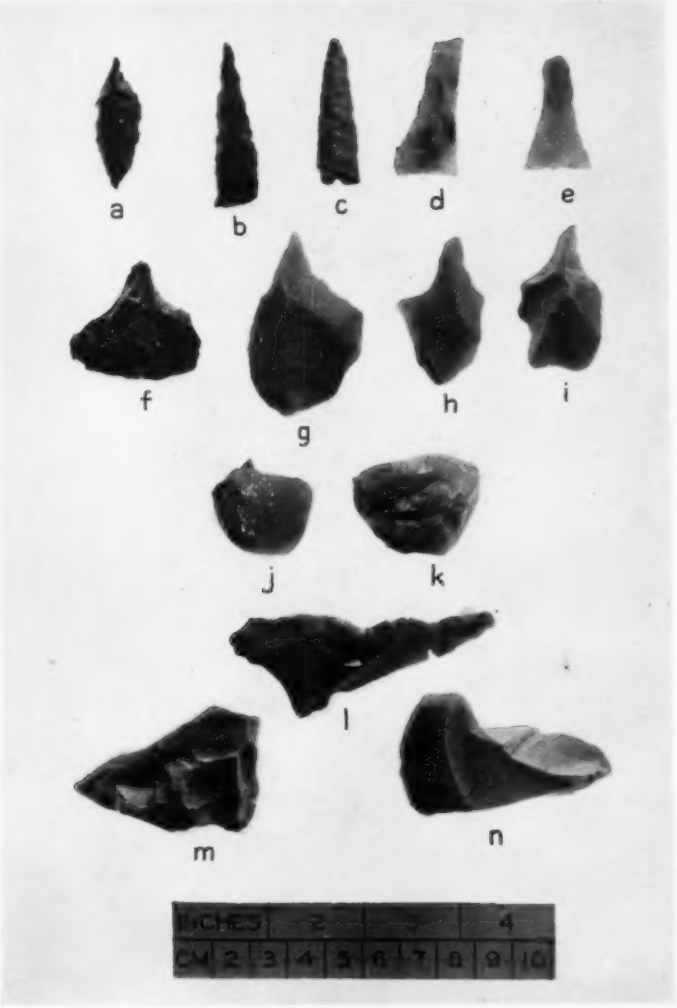
[5] Howard, Satterthwaite and Bache, 1941.



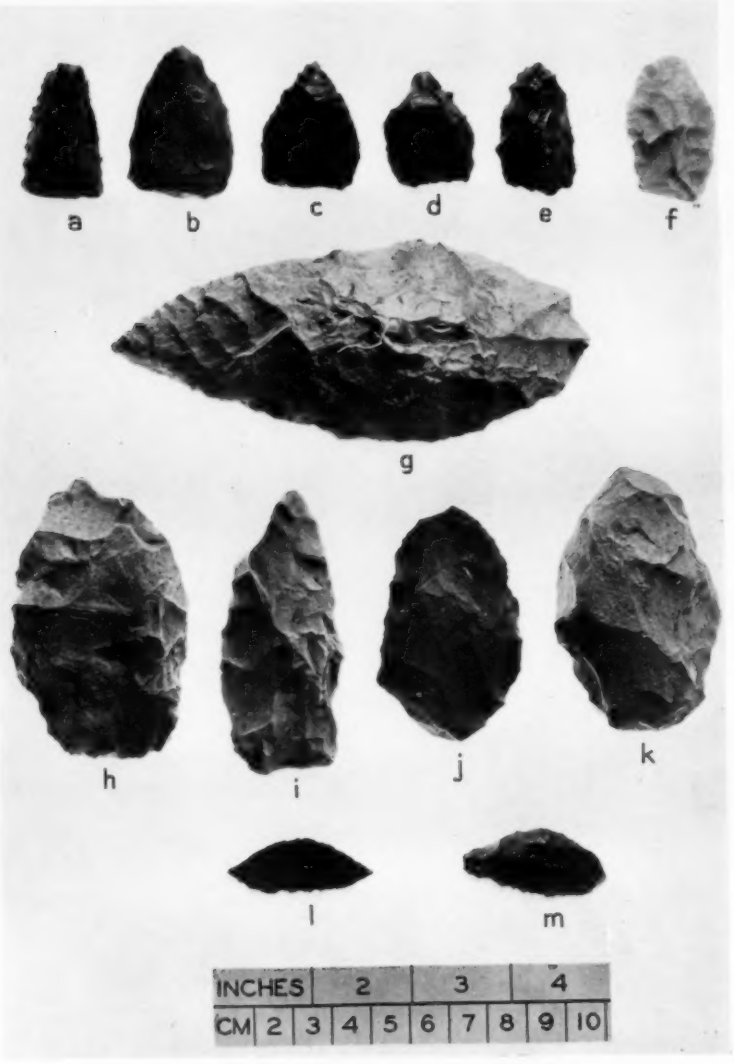
Projectile points from sites near Grants, New Mexico.
a–v Lobo complex; *w–h'* San José complex.



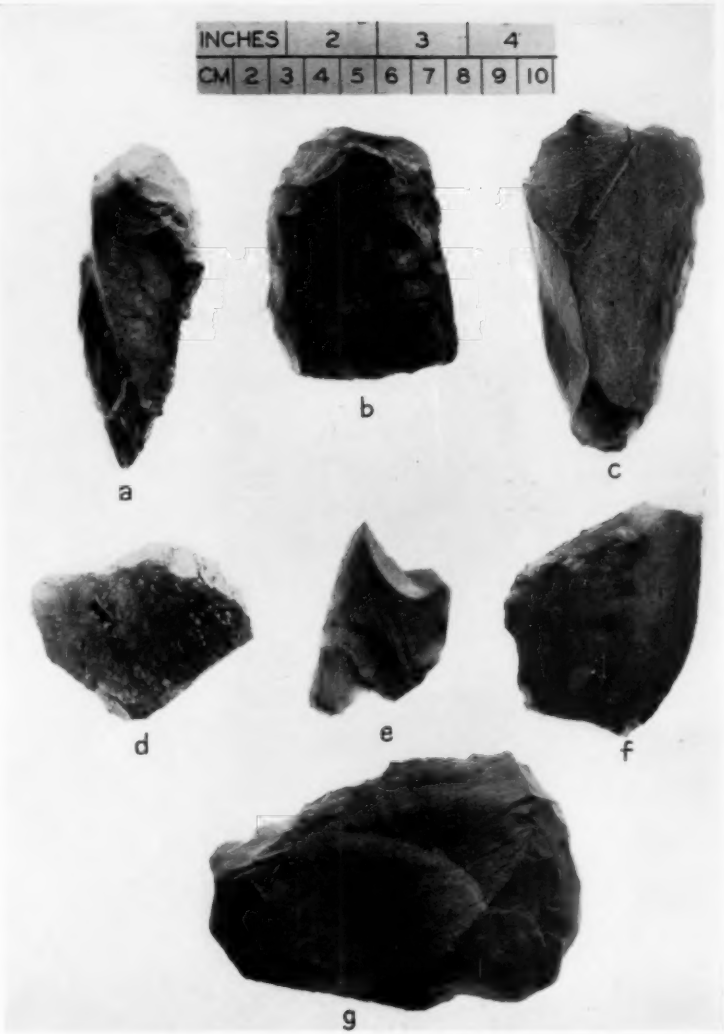
Projectile points associated with the San José complex.
a–d, Pueblo; *e–h*, unknown affinity.



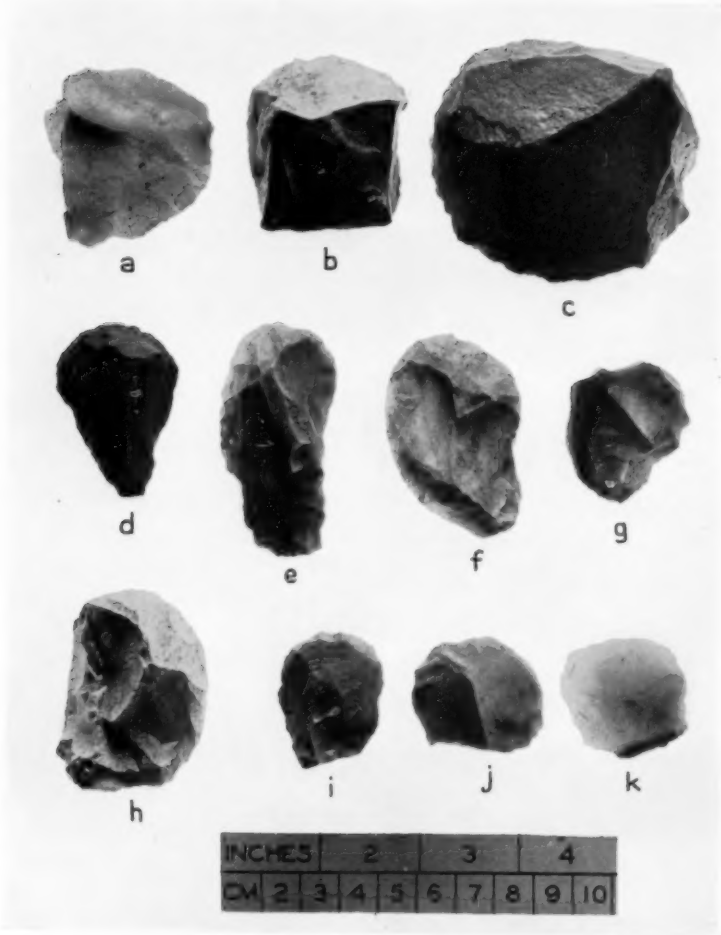
Drills, gravers, and concave scrapers of the San José and Lobo complexes, New Mexico.



Points and blades of the San José and Lobo complexes, New Mexico.



Scrapers of the San José and Lobo complexes, New Mexico.



Scrapers of the San José complex, New Mexico.

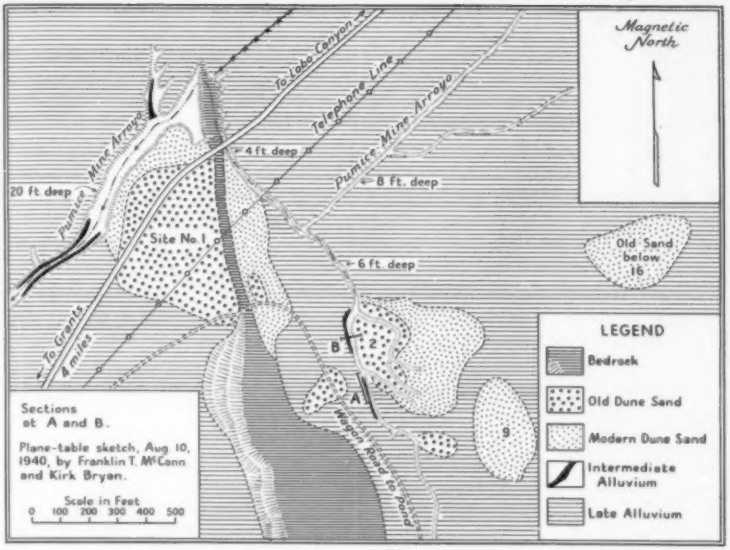


FIG. 25.—Plane-table sketch of San José area, near Grants, New Mexico.

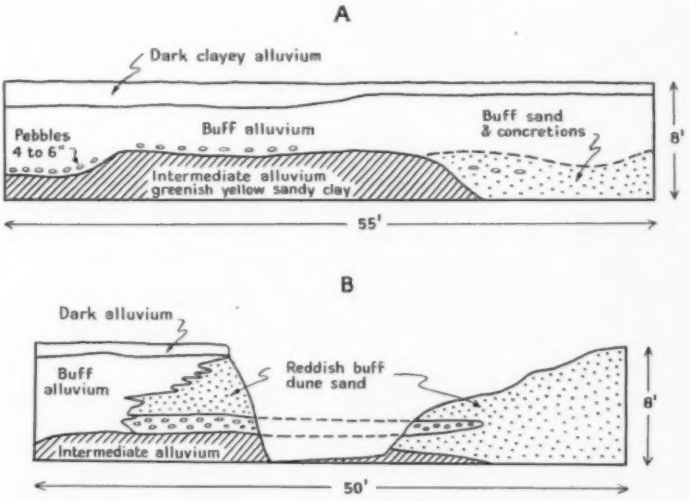


FIG. 26.—Cross-sections of sands and alluviums (see Fig. 25 for location) near Grants, New Mexico.

TABLE 2

CORRELATION OF DUNES AND ALLUVIUM AT GRANTS, NEW MEXICO, WITH GEOLOGIC EVENTS AND HUMAN CULTURES IN THE SOUTHWEST

Events	Grants, New Mexico Bryan and McCann		Big Bend, Texas Albritton and Bryan, 1939 Kelley and Campbell, 1941		Hopi Country, Arizona J. T. Hack, 1942		Whitewater Draw, Arizona Sayles and Antevs, 1941	
Erosion and Wind action	Modern dunes Modern arroyo	Present action Since 1885?	Modern arroyo	Since 1885?	Modern dunes Modern arroyo	Present action Since 1900 +	Arroyo	Since 1885?
Deposition 3	Flood plain in San José Creek Upper part of "Late Alluvium"	No data on age	Kokernot formation		Naha formation	After 1300 AD	Deposition upper silts	Pottery culture 1100 to 1400 AD
Erosion and Wind Action	Late Dunes	Pottery 875 to 1100 AD and Lobo complex	arroyo	Chisos focus 800–1400 AD / Livermore focus	Erosion and possibly some wind action	After 1200 AD Before 1500 AD	Erosion surface	No data on age
Deposition Possible erosion Deposition 2	Late Alluvium Weathering of top of "Old Dunes"	No direct data on age of Late Alluvium --?---?---?-- San José complex --?---?---?--	Upper Calamity Erosion? Lower Calamity Wind action Broad gulley	Pecos River Focus --?--?--?--?--?--?--? Santiago complex Maravillas complex	Tsegi formation (A) Possible erosion Tsegi formation (B)	Occupation but no data on age	Clay and sand Erosion surface Clay and sand	San Pedro stage No date on age Chiricahua stage (2 serrated points)
Erosion and Wind action	Old Dunes Broad gulley				Dunes Broad gulley	Earlier than 700 to 900 AD	Erosion surface	No data on age
Deposition 1	Intermediate alluvium and Terrace	No data on age	Neville formation	No known occupation *Elephas* *Equus*	Jeddito formation	No known occupation *Probiscidean*	Sand, gravel and clay	Sulphur Springs stage *Elephas*, etc.
Erosion	Erosion	. . . . .	Erosion	. . . . .	Erosion	. . . . .	Marked erosion surface	. . . . .

time when more information is obtained, further comment is unnecessary.

The name Lobo complex is given to a group of stone implements consisting of serrated and non-serrated points smaller than those of the San José complex, drills, knives, scrapers, and grinding implements. The projectile points are diagnostic. As shown in Plate XIX, *a–v*, the points are small and either wide or narrow. They range in length from three quarters of an inch to an inch and a quarter. Many of the serrated points are narrow, but thick in cross-section and are crudely or carelessly chipped (Pl. XIX, *c*). A flake facet commonly makes most of one face. The denticles are small and more irregularly spaced than in the San José points. The tang is most frequently a nub. Other points have a broad and fairly long tang and a rounded or rudimentary point. It may easily be, as some authors hold, that these were hafted knives, not projectile points. Other points are nearly shapeless and grade into the tangless points shown in Plate XXII, *a*, *b*, which are also found in the San José and Pueblo cultures. In general, the Lobo points are less well-finished than those of the San José. Associated with these points are Puebloan projectile points (Pl. XX, *a–d*), Puebloan "expanded-base" drills (Pl. XXI, *d* and *e*), somewhat thinner end and side scrapers (Pl. XXIV, *g–k*), and pottery. Also common to this complex, as well as the San José, are leaf-shaped points, leaf-shaped knives, choppers, and the mano and metate that are identical in the two complexes. Side scrapers are more numerous than snub-nosed scrapers in the Lobo complex. The snub-nosed scrapers are thinner and a few scrapers are definitely crenulated.

The association of Puebloan points and pottery with the Lobo complex raises the question whether these stone objects are the work of a Puebloan or non-Puebloan people. As more particularly discussed below, this question cannot be definitely settled on the basis of the present facts. It seems preferable to give a name to the complex of objects, although it is recognized that the makers were contemporaneous with Puebloans and may have been partly or wholly fused with them.

The chipped implements are largely made of volcanic glass and of various kinds of flint. The glass is a black pitchstone easily distinguishable from the obsidian commonly used in New Mexico. It occurs in the sites in unworked rounded masses from one to three inches in diameter. Such masses are common in the pumice mine now being worked in Pumice Mine Canyon. Local derivation is thus certain and a supply of this material may have been a factor in the location of these camps.

The size of the rounded masses affects the form and size of the implement that can be made and the San José points made from this material are noticeably broader in proportion to length than points made from flint. Scrapers are also smaller and more compact in form.

A few implements of translucent obsidian are also found. Whether this material is derived from unlocated sources in the Mt. Taylor area or from more distant sources such as the Jemez Mountains, some ninety miles northeast, is not known.

The flint is largely gray, weathering to brownish, cream colored, and whitish. It is obviously derived from the nodules in the Pennsylvanian limestone of the Zuñi Mountains. These limestones crop out on low plateaus immediately south of the San José Valley. Here is a large supply of flint.

Various other flints, red and mottled from the Chinle formation, silicified wood from the Chinle or Cretaceous rocks and fine-grained siliceous rock from unidentified sources were also used. Several types of fine-grained volcanic rocks, presumably derived from outcrops in Mt. Taylor or from stream gravels, were used. Manos and metates were made from sandstone, mostly obtained from nearby outcrops of the Morrison and Chinle formations.

DESCRIPTION OF THE SITES

Grants 6. The locality having the greatest concentration of artifacts is Grants 6 which lies south of the town of Grants on the north bank of the San José. It is a large blowout due to recent wind excavation of previously stabilized dune sand. Erosion appears to have been induced by the cut made by the logging railroad, shown in Figure 24. The site is approximately 1000 yards east and west and 500 yards north and south. The blowout is formed mostly by southwest winds, and there is a bank two to five feet high on the north side with a number of outlying wind-eroded remnants. Most of this bank is composed of compact and slightly yellow or reddish sand with calcareous concretions. The top six inches is more compact and brownish, and in places contains flecks of charcoal and ashes. This is the "Old Dune" sand of the geological report. The overlying sand is whiter and less compact. Part of it is being added to each time the wind blows, and part is being eroded. The former is the "Modern Dune" sand and the latter is the "Late Dune" sand of the geological report. In the southern part of the blowout it seems that there was once a large deposit of "Late Dune" sand, as in this part of the site (referred to as Site 6A) artifacts of the Lobo complex only were found.

Many hearths consisting of circles and collections of fire-marked rocks two to three feet in diameter occur. There are also many fragments of bones. Associated are numerous artifacts and flint chips. In collecting, the best preserved hearths were selected, all flint chips and fragments of grinding tools were removed. Thereafter, these areas were inspected

by Toulouse each week for several months during 1938. As the wind removed the sand, artifacts and chips were exposed; thus, association between hearths and bones and association of the two with certain artifacts were established. All the artifacts thus found are assigned to the San José complex. The characteristic serrated projectile points particularly those shown in Plate XIX, *w–d′*, *f′*, and *h′*, and also some of the aberrant forms (Pl. XX, *e–h*), were thus found and their contemporaneity established. The implements extend downward from the hard top of this dune sand to depths of one to two feet only. This fact is established by the systematic collecting already mentioned and also by the careful excavation of one of the hearths. It is obvious that a camp of the San José complex was located on this dune when its building was essentially complete. The inclusion of hearths and artifacts in the sand is apparently only as deep as might be expected to result from camp activities in a sandy location.

The fragmentary bones collected from the Old Dune sands were examined by the late Professor Glover T. Allen, Curator of Mammals in the Museum of Comparative Zoology of Harvard University, who identified the following species: *Odocoileous hemiones*, Mule deer; *Antilocapra americana*, Pronghorn; *Bison bison*, Bison. These modern animals were obviously used for food. Mule deer and antelope still survive in the area. Bison, however, are extinct, and may have been extinct in this area at the time of the Spanish conquest.

The Late Dune sand to the north of this site is presumably of some date within the Pueblo period as a small Pueblo point (Pl. XX, *a*), was found by Bryan in situ about eighteen inches below the surface. In the southern part of this site, here referred to as 6A, sand later than the Old Dune and much less compact, once existed as low mounds. The artifacts found in this area by Toulouse and apparently derived from this sand have been placed in the Lobo complex. Here also were found a few potsherds of a generalized Pueblo style dating between 875 A.D. and 1100 A.D. Thus, the Late Dune sand in Sites 6 and 6A contains both Lobo and Pueblo artifacts and the two complexes are contemporaneous.

Grants 5. This blowout lies to the north of Site 6. The wind has excavated Old Dune sand which is red, compact, and contains concretions three-sixteenths of an inch in diameter and one to three-quarters of an inch long. At the top, this sand is blackish brown and is overlain by about two feet of light colored sand. When this site was first found, only this light colored sand was exposed. Artifacts found here are a few Lobo points and manos. During road construction in 1939 and 1940 this area was used as a borrow pit; subsequent wind erosion revealed the geologic section described above.

Grants 10. This is a large blowout south of San José Creek. It is more than 2000 feet from east to west and 300 feet north and south at the maximum. The Old Dune is exposed to a depth of four feet on the north edge of the blowout where it is overlain by lighter colored sand. Artifacts of both San José and Lobo complexes occur in this site. Bones of mule deer and bison collected here were identified by the late Professor Allen.

Grants 7. This is a narrow east-west cut probably developed in an old road that crossed a low dune. Brownish red sand is exposed at the base. It contains fragments of basalt but no concretions. The overlying sand is light in color. From the lower sand Bryan collected a mano, a metate, several utilized flakes, a thin thumb-nail scraper, a Lobo point and pottery of Pueblo I date (700–900 A.D.). Toulouse had previously collected a few artifacts but no distinctive material. The brown sand is presumably Late Dune sand and the light colored sand is presumably the modern sand.

Grants 12. Two camp sites in Sec. 4, T. 12 N., R. 9 W. and the contiguous Sec. 33, T. 13 N., R. 9 W. lie on inconspicuous mounds of light colored sand typical of the Late Dunes. Here pottery of a style dating between 875 A.D. and 1100 A.D. and similar to that of site 6A was found in association with hearths. It seems probable that Old Dune sand underlies these mounds.

Grants 1. This site is visible from the town of Grants as a light colored patch, 3.5 miles north on the Lobo Canyon road. It is a blowout lying between the eastern edge of the arroyo and a sandstone ridge (see Fig. 25). Old Dune sand, reddish and compact with limey concretions, is exposed to a depth of three to four feet. Persistent collecting shows that there are no artifacts below a depth of two feet. On the southeast, light colored sand is exposed. Artifacts of both complexes have been collected at this site. A San José point found here is illustrated in Plate XIX, *e'*. Lobo points are more common in the light colored sand to the southeast. Thus, the main body of reddish sand presumably carries the San José complex and is the Old Dune sand.

Grants 2. This site lies east of Site 1 in a gullied area. Compact reddish sand is overlain by one to two feet of light colored sand. No projectile points have been found. Artifacts in the light colored sand are presumably from the Lobo complex.

Site 9. This is a small blowout in the open flat north of Site 2. Only loose, light colored sand is exposed. Here artifacts of the Lobo complex were found.

Other sites. Other sites shown by numbers on the map (Fig. 24) are also in low dunes. Most of them have no notable features and are relatively poor in artifacts.

CORRELATION OF THE COMPLEXES

In the past few years, discoveries of artifacts in association with geological deposits have been numerous. Difficulties in archaeological correlation arise by reason of the relatively small collections obtained and also by reason of the wide variety of lithic types that have been

TABLE 1

SITES IN GRANTS AREA

No. of Site	Sand Present	Complex Represented
1	Old, Late	San José-Lobo
2	Old, Late, Modern	Drill, leaf-shaped knife, metate and mano, Lobo?
3	Old, Late, Modern	Flakes, only
4	Old, Late, Modern	Lobo in Late Sand
5	Old, Late, Modern	Lobo and Pueblo in Late Sand
6	Old, Late, Modern	San José in Old Sand, Lobo and potsherds in Late Sand (6A)
7	Late, Modern	Lobo and potsherds
8	Late, Modern	Artifacts?
9	Late, Modern	Lobo
10	Old, Late, Modern	San José, Lobo
12	Old, Late, Modern	Lobo
16	Late, Modern	Chips, oval knives, choppers

found. This variety of types may be due to changes in style occurring during the course of time and it may thus have chronological importance. It may be the result of geographic separation of peoples diverse in culture. Of the types of implements found, projectile points seem to be the most significant, although further study may show that the forms of other implements may serve equally well in discriminating one culture from another.

The characteristic feature of the projectile points of both the San José and Lobo complexes is the serrated edge. Such points are not uncommon in collections and are usually considered to be characteristic of one or more of the older cultures of the Great Plains area. This indefinite attribution has no present value. Similar points of known archaeological horizons are not numerous.

As described by Campbell,[6] two projectile points are known from the Maravillas complex of the Big Bend region of Texas. These points were made from flakes and have serrated edges and straight tangs. One has well-defined shoulders giving it a strong tendency to "leaf shape"; the other has much smaller shoulders now broken off. Four points are de-

[6] Kelley, Campbell and Lehmer, 1940, pp. 111–117, Pl. XVII, *b*.

scribed from the Santiago culture of the same area. These points are also made from flakes and are serrated. They are somewhat smaller than the points of the Maravillas complex. One type is triangular and has a concave base, the other has a concave base with shallow lateral notches. Both styles of points have strong resemblances to the points of the San José complex. Thus, the point in Plate XIX, *z*, is quite similar to the first type of the Santiago complex (Campbell's Pl. XVII, *a–l*). The concave-based tangs of the San José with their flaring corners are markedly distinct. The points of the Chisos focus[7] (of the Big Bend Cave aspect) have bases somewhat similar in form to the San José, although the serrated edge is not so prominent. The age of these Texas cultures is determined by geological and archaeological means. The Maravillas falls in the interval of erosion separating the Neville and Calamity formations. The Santiago lies in the upper portion of the lower part of the Calamity formation. In the Sheep Creek–Calamity Creek Valley, this formation has an erosional break dividing it into an upper and a lower portion. The Chisos focus occurs in the erosion interval between the Calamity and Kokernot formations and also within the base of the Kokernot. It is broadly equivalent to the Livermore focus of the same aspect. A projectile point characteristic of the latter focus was found in Mogollon Village, New Mexico, in an horizon dated by tree rings as ending about 900 A.D.[8] A general date ranging from 800 to 1400 A.D. for the Chisos and Livermore foci is given by Kelley and Campbell.[9]

Sayles[10] reports and illustrates serrated points from several Texas complexes. Small serrated points with stems occur in his Hasinai culture (Pl. XXIV, *c, f, i*). Larger points, mostly with stems, but one of which has a base not very different from the San José, are attributed to the Late Brazos River (Pl. XXI, *a, c, d, h, i, k*). Serrated points with concave base and side notch occur in his Late Edwards Plateau culture (Pl. XXII, *b, c, d, e, f*). Kelley and Campbell[11] consider that the Late Edwards Plateau is equivalent in age to their Chisos focus, and that the serrated points are Chisos.

Sayles[12] illustrates projectile points found with the grinding, chopping, and scraping tools of his Chiricahua stage of the Cochise complex in the Sulphur Springs Valley of southern Arizona. Two of these points have serrated edges. One has an indented base and side notches which, although different, is a style within the general range in form of the San José points. Sayles considers that these points are "intrusive," i.e. not characteristic of the Chiricahua people who, according to his analysis,

[7] *Ibid.*, p. 63, Pl. V, 2, *a*; p. 69, Pl. VI, *j* and Pl. XX, Fig. 3.
[8] *Ibid.*, p. 161. [9] *Ibid.*, p. 163. [10] Sayles, 1935.
[11] Kelley, Campbell and Lehmer, 1940, p. 146. [12] Sayles and Antevs, 1941.

were wholly food gatherers. These points are thought by him to have been acquired from contemporary people. This interpretation may seem somewhat strained, but for purposes of correlation, the mere presence of the points is adequate. The Chiricahua stage can be no older than the making of the serrated points. The Chiricahua stage, characterized by manos, metates, choppers, scrapers, and associated with a modern fauna was thus presumably broadly contemporary with the related Maravillas and Santiago complexes and less securely with the Chisos of Texas and with the San José of the Grants area.

The Lobo complex is similar to the San José except in its projectiles and in its association with pottery and projectiles of Puebloan or Anasazi types. The Lobo projectiles differ from those of the San José principally by reduction in size and in the degree of serration. The substitution of a nub for the end and side notches of the base or the extension of the base also occurs. They are also more crudely made and appear to be a style successive to but also degenerate from the San José.

Points of this general aspect are not unknown in Pueblo ruins. Brew[13] found a small serrated point like the point illustrated in Plate XIX, *c*, in the debris of a Pueblo II Kiva on Alkalai Ridge, Utah (Site Ab 7-7). As the pottery found in this debris was also of Pueblo II date, the point is presumably of this date or at most slightly older.

Kidder[14] illustrates irregular obsidian points from Pecos which he considers knives, similar to those shown in Plate XXII, *a*, *b* and Plate XIX, *o*, *t*, *u*. He also shows three serrated points in his Fig. 8, *a*, *b*, *c*, which are not far different in shape from the serrated Lobo points. Serrated points are rare at Pecos, as only three were found. Haury[15] found a serrated point in a Mogollon site at Forestdale, Arizona, which is slender and has side notches so that it differs materially from the Lobo and San José points. It has a date of Late Basketmaker III or Early Pueblo I, i.e. 600–800 A.D. Roberts[16] reports a serrated point from Kiatuthlanna, which has strong barbs and thus differs materially from San José and Lobo points also. This village is presumably later than the site at Forestdale. Two serrated points were, likewise, found in Jemez cave.[17]

The association of Lobo points with pottery and projectiles of Pueblo I date in the sites near Grants may be interpreted in either of two ways. The sites may have been used alternately, at short intervals, by Pueblo and by non-Pueblo peoples, either peaceful or hostile neighbors. The very small number of potsherds found would, however, indicate that

[13] Brew, J. O., personal communication. The point is Peabody Mus. No.33-7.10/835.
[14] Kidder, 1932, Figs. 7, 32.
[15] Haury, 1940, Fig. 38, *o*.
[16] Roberts, 1931, Pl. 39, *d*.
[17] Alexander and Reiter, 1938, Pl. 7, *g*, *h*.

the camps were not occupied for any great length of time by Pueblo people. On the other hand, the Lobo points may have been made by an element recently joined to, and only partly absorbed into, the Pueblo culture. The data available are inadequate to consider the problems involved in these two hypotheses. Only search for and excavation of a contemporary house site of the same Pueblo stage and a thorough survey of the region for sites of contemporary hunting peoples will solve the cultural questions here raised.

The finds of serrated points in various Pueblo and Mogollon sites as set forth above demonstrate that the serrated points—especially small and relatively slender points not greatly different from the Lobo—mark a style contemporary with the Puebloan culture from Basketmaker III on to at least Pueblo IV. That these scattered finds are to be attributed to any one group of non-Puebloan or partly absorbed people is not here implied. The only inference that appears to be valid is that the style of point and the Lobo complex in particular are of Puebloan and presumably late Puebloan date.

The San José complex implies the existence of a hunting, food-gathering people who used no pottery. They may easily have pre-dated the use of pottery and the Puebloan culture. It is possible to postulate that they may have been one of the tribes composing the hypothetical Basketmaker I. Such an early date might be conceived if they were equivalent in time with the Maravillas and such a postulate would fit into Sayles's ideas on the antiquity of the Chiricahua stage of the Cochise complex. But as serrated points continued to be made in Texas in the Santiago and Chisos cultures to very late dates, the San José, on typological grounds, might be much later than Basketmaker I. An assumption as to great antiquity is hardly justified by present knowledge of the San José or the cultures of Texas.

The geological correlation in the accompanying paper by Bryan and McCann places the San José at the close of a period of erosion and presumably largely in the ensuing wetter periods of the intermediate alluvium. This accords well with a correlation of the San José with the Chiricahua and Maravillas cultures. With this somewhat indefinite dating, we must perforce remain content.

Geological Museum
Cambridge, Mass.

Gran Quivira National Monument
Gran Quivira, New Mexico
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SAND DUNES AND ALLUVIUM NEAR GRANTS, NEW MEXICO

KIRK BRYAN and FRANKLIN T. MCCANN

PROGRESS in knowledge of the more ancient stone cultures in North America has made increasingly apparent the existence of a gap in time between the fairly well-known, modern North American Indian and his Paleo-Indian predecessors.[1] The extent of the break presents a problem to both archaeology and geology. Obviously, it is possible to approach the problem by leading from the earlier horizons toward the later, or in the reverse direction. The expansion and development of the "alluvial chronology" affords a basis for approach from the later horizons, as the last events in this chronology are effectively dated in the pottery cultures of the Southwest.[2] The discovery by Mr. Joseph H. Toulouse, Jr., of the stone artifacts of a hunting people, who did not use pottery, in the heart of the Pueblo area appeared to offer such an opportunity. It seemed that it might afford a series of stages transitional backward from the known dates of the Puebloan stages toward the remote Paleo-Indians. The geologic results raise more problems than are solved, yet have some importance in extending knowledge along the fringes of the problem.

The sites discovered by Toulouse occur in blowouts or wind-scooped hollows which reveal three types of sand, here called (1) Old Dune Sand, (2) Late Dune Sand, and (3) Modern Dune Sand, which are associated with three alluviums, here called (1) Early Alluvium, (2) Intermediate Alluvium, and (3) Late Alluvium. Associated with these sediments are four relatively recent basalt flows.

One day in August, 1939, was spent with Toulouse inspecting the area. Bryan visited Site 6 on August 31, 1939, and Bryan and McCann spent August 7–10, 1940, in field work. Toulouse was present on August 7, 1940.

The town of Grants, which lies in the valley of the Rio San José about halfway between Albuquerque and Gallup, is an important point on the through east-west highway, Route 66, and on the main line of the Santa Fe Railroad, and dates from the building of the Atlantic and Pacific Railroad (Santa Fe Coastlines) in 1882.

The town lies at the southern foot of the basalt-capped mesa surrounding Mt. Taylor and on the northern margin of the great lava fields that stretch southward to the Datil Range fifty miles away. These lavas have poured northward into the valley of the Rio San José and

[1] Roberts, 1940. See Bibliography, pp. 291–295, following.

[2] Summarized in Bryan, 1941.

crowded that stream to the north side of its valley. There appear to be four main flows in the valley at this point. As brought out by the detailed studies of Nichols,[3] the main body of lava entering from the south is the Laguna Flow which extends down the valley of the Rio San José for more than thirty miles. This flow is sufficiently ancient so that the San José has been able to cut into it a narrow, steep-walled gulch. The McCartys Flow entered the valley about six miles below Grants at a more recent date and forms for the next six miles a spectacular feature. A third, unnamed flow, not much older than the McCartys, moved from the south into the area west and south of Grants. Here it overlies the Laguna Flow, and, as it is confined to the area of the Laguna Flow, it does not affect the courses of streams and cannot be brought into the sequence of events. The Bluewater Flow, also relatively recent, extends from its source, a cone on the flank of Mesa Redonda, into the valley of the Rio San José above the town of Bluewater and thence down the valley for about seven miles. It is more or less covered with alluvium and ends, or disappears, near Toltec Station, five miles west of Grants.

Between the westerly edge of the Laguna Flow and the easterly edge of the Bluewater Flow, the San José runs in a broad, alluvial valley. This valley contracts suddenly at Grants into a narrow canyon from twenty to forty feet deep. Here the older or Laguna Flow is cut into two parts and the town is mostly built on the northern fragment.

The sand dunes and blowouts of the Grants area are of several ages, yet have a somewhat similar distribution and history. They are not widespread features, but are developed as relatively small bodies of sand on the flood plains of the San José and its tributaries and also on adjacent low lava plains. The dunes are mounds of sand of various shapes, two to five feet high, and usually of small areal extent. Associated with the dunes, ancient and modern, are small blowouts or wind-scooped hollows from which most of the sand for the dunes has been derived. Ancient blowouts, however, are rarely preserved as topographic features and the blowouts in which Toulouse found his artifacts must be considered as modern and associated with modern dunes.

Although in the blowout sites of the Grants area almost anything may be found, they clearly reveal three types of sand, the Old Dune Sand, the Late Dune Sand, and the Modern Dune Sand.

The Old Dune Sand has a reddish color, is compact, and contains concretions of calcium carbonate. It has a definite top which at Site 6 contains humus and ashes. In this site artifacts attributed to the San José culture are concentrated at or near the top. Most of them occur in

[3] Nichols, 1934. Also numerous papers on McCartys Flow.

the upper six inches and none have been found below a depth of two feet.

The Late Dune Sand, which is younger than the Old Dune Sand, is slightly compacted and may, as at Site 7 and elsewhere, be reddish in color. Elsewhere it is buff to white in color. Near the top, it contains thin films of calcium carbonate on vertical joints. There are no concretions. The artifacts are attributed to the Lobo culture and seem to correlate with artifacts and pottery of Pueblo date.

The Modern Dune Sand is loose and usually uncolored. The slight coloration of the older sands appears to have been lost in transit. Under the present wind system, in which southwest winds are dominant, small dunes are formed which are usually more or less covered by vegetation, either grass or such bushes as chico, chamiso, or rabbit-brush. Associated with them are blowouts, one to three feet deep, with a rim of vegetation-covered sand on the north and east. Within the blowouts the rate of sand movement is sufficiently rapid so that plants cannot grow. Blowouts are especially common in the vicinity of the older dunes where wind excavation of previously deposited sand proceeds too rapidly for vegetation to grow. The Modern Dune Sand is largely barren of artifacts, except for scattered cartridge shells, tin cans, and other evidence of modern occupation.

The character of the alluvium in the Grants area cannot be discussed in general terms, chiefly because of lack of critical exposures, but must be considered in terms of some particular locality where exposures are adequate. Such a locality may be found northeast of Grants. Here a strong arroyo drains the west slope of Horace Mesa and the south slope of a long, unnamed mesa on the flanks of which a white scar marks the pumice mine from which the southward-draining arroyo takes its name. Headward, this arroyo is separated by a low pass from Lobo Canyon, the best route to the high country of Mt. Taylor. The valley of the Pumice Mine Arroyo and Lobo Canyon are occupied by a highway and telephone line (Fig. 24).

Sites 1, 2, 9 and 16 are located on the Pumice Mine Arroyo about four miles northeast of Grants. In this vicinity, the geological relations are clearer than elsewhere in the area (Fig. 25). The main arroyo comes from the northeast in a straight course obviously excavated along an old road. It is joined by a tributary from the southeast and crosses a rock ledge to plunge into a much deeper and wider arroyo that pursues a southwesterly course toward Grants. This arroyo becomes more and more shallow and finally fades out in a grassy flood plain where a new arroyo begins and pursues a course southeastward along the northern edge of the Laguna Flow.

The rocky ledge consists of a bed of sandstone with a northerly strike and a dip of about 10 degrees. It is one of the upper members of the Morrison formation. The arroyo with northwesterly course drains a strike valley between this sandstone and the sandstones of the Upper Cretaceous. In this valley, approximately a mile from the telephone line, is a wet-weather pond enclosed between two alluvial fans.

The alluvium of the valley of Pumice Mine Arroyo varies in character with the source. Streams originating north and east of the area shown in Figure 25 derive alluvium from the outcrops of cretaceous beds and of lava in the adjoining mesas. This alluvium, found upstream from the rock ledge, is a yellowish, or greenish-yellow, sandy silt or silty clay with gravels largely of volcanic pebbles. South of this area, the streams from the mesa on the west bring in alluvium derived from the Morrison and Chinle formations. This material is more reddish in color but otherwise quite similar.

In spite of its superficially homogeneous appearance, the alluvium upstream from the rock ledge consists of two alluviums which in places are separated by a distinct unconformity. The older alluvium contains lime concretions up to two inches in diameter, which the younger lacks, and is the more compact of the two. Exposures in the banks of Pumice Mine Arroyo downstream from the rock ledge likewise show two kinds of alluvium. The main part is unconsolidated, sandy silt and clay which underlies the adjacent flood plain. It was obviously being deposited up to the moment when the arroyo was cut. In localities on the borders of the flood plain, every rain adds new material to the undissected portions of this alluvium. As the course of the arroyo upstream, and probably in part downstream, follows an old road, the cutting must be recent and presumably within the last sixty years when other arroyos were cut in the Southwest.[4] Below this latest alluvium, and separated from it by a marked erosional unconformity, lies a compact alluvium otherwise similar except that it contains more reddish material from the western tributaries. In places near the top, this body of alluvium contains soil zones which are quite well-developed. It appears that during this period of alluviation the top of the flood plain was four or five feet lower than during the later period of alluviation.

If the Pumice Mine Arroyo is followed downstream, the outcrops of the older alluvium become more numerous. A distinguishing feature is its relative resistance to erosion by floods. It is carved, grooved and fluted, displaying all the phenomena impressed on the hard rocks of its bed by the silt-laden Colorado River.[5] In this lower part of the Pumice

[4] Bryan, 1925. [5] Campbell and Maxson, 1939.

Mine Arroyo, the flood plain is bordered by a terrace about twenty feet high. As this terrace is composed of alluvium, it is obvious that there are three alluvial fills in the valley.

The partial relationship of sand dunes, alluvium, and basalt may be observed at several places in the Grants area. The entire relationship of the three sands, the three alluviums, and the four basalt flows cannot be observed at any place, but must be pieced together from observations made at several localities.

In the broad plain west of the Laguna Flow, the dunes form broad low mounds through which drainage from rains only in part reaches the San José. This stream lies at the northern border of its valley and is incised in an arroyo four to ten feet deep. The arroyo is bordered by alluvium, and a narrow strip of this alluvium lies between the mounds of sand and continues into the canyon cut in the lava. It is obvious that the alluvium is younger than most of the dunes and also younger than the canyon cut in the lava flow. In this locality there are no distinctive sections and this conclusion cannot be demonstrated in a single locality but must be inferred from the general relations.

The open plains north of the railroad are a broad complex of alluvial fans where the waters of Lobo Canyon, San Mateo Creek and other ephemeral streams spread out. Here are the dunes and blowouts in which Sites 12A and 12B are located. It is impossible, however, to determine the relationship of the alluvium, which is being increased in every flood period, to the dune sand. In Sections 22 and 23, T. 13 N., R. 9 W., San Mateo Creek has a well-defined arroyo. Here, large sand dunes are banked against the south slopes of the valley. The sand of these dunes is reddish and upper parts of the dunes are eroded. It can easily be shown that they are older than the latest alluvium of the valley but, as yet, no artifacts have been discovered in them. They may be of the same age as the older dunes to the south, but such a conclusion can at present be merely hypothetical.

The best exposures are in Pumice Mine Canyon. At Site 1, the Late Alluvium appears to wrap around the Old Dune Sand, but there are no exposures of the contact. At Sites 2 and 9, the Old Dune Sand crops out in the hillside near the wagon road and extends under a narrow band of Late Alluvium into the main body of the old dune. The Old Dune Sand has been exposed by the stripping of the surface by wind and by the erosion of minor arroyos. The Modern Dune Sand thus excavated by the wind forms the surface over a large area of low hummocks and blowouts to the north and east. To what extent the Late Dune Sand is concealed under the Modern Dune Sand is not

evident in exposures but Lobo type artifacts are found on the eroded older sand. On the alluvial plain to the north are other bodies of sand consisting largely of Modern Dune Sand. Site 16 is such a locality.

As shown in Figure 26, A, which is a diagram of the good exposures in the south wall of the arroyo near Sites 2 and 9, the Late Alluvium rests on the Intermediate Alluvium with a strongly marked unconformity. At the base, the Late Alluvium consists of beds of angular, only slightly waterworn rock fragments ranging up to four inches in maximum diameter. These gravelly beds grade laterally into buff, silty and sandy clay which itself grades upward into a dark, humus-bearing sandy clay with vertical joints that forms the upper one to two feet. The Intermediate Alluvium is a compact, yellow or greenish yellow or buff, clayey and silty sand with calcareous concretions as large as one inch in diameter. To the northwest, in the direction of the main dune (Sites 2 and 9), the Late Alluvium overlies a reddish buff, compact sand. This body of sand is continuous with the main body of Old Dune Sand. The water-laid Late Alluvium grades into the sand which is largely wind-laid. The contact of the sand with the Intermediate Alluvium is a sharply defined unconformity and lines of stones extend out into the sand. It appears that as the sand accumulated, rains washed debris from the bank of Intermediate Alluvium into the border of the dune. The gradational contact of the sand and the Late Alluvium does not necessarily imply contemporaneity. If ephemeral streams deposit material around, and partly over, a low mound of wind-blown sand, it may be expected that the sand will be eroded and redeposited in intimate mixture with the main body of water-laid material.

This relation is brought out in Figure 26, B, a cross-section of the arroyo a few feet northwest of the section of Figure 26, A. Here the Old Dune Sand forms the north wall of the arroyo and extends as a low mound above the level of the Late Alluvium which forms the top of the bank on the south side of the arroyo. The Intermediate Alluvium crops out at the foot of the bank on both sides and is overlain by coarse gravel on the south and dune sand on the north. The gravel, however, extends across the arroyo as a lens in the dune sand. It obviously represents a stream that cut into both the Intermediate Alluvium and the Old Dune Sand. The dune sand was redeposited by rainwash or wind action over the gravel and forms the bank on both sides. To the south, the Old Dune Sand has a blurred and transitional contact with the alluvium but is definitely, and apparently unconformably, overlain by the upper dark member of the Late Alluvium. From these exposures and the general relation of the masses of Old Dune Sand to the alluvium, there seems no doubt that both the Late Alluvium and the Old Dune Sand were deposited on the eroded remnants of the Inter-

mediate Alluvium. That the Late Alluvium is unconformable on the Old Dune Sand is less clear. This relation is, however, established by the contacts described above and by the areal relations in which Late Alluvium surrounds mounds of Old Dune Sand as shown in Figure 25.

From the foregoing evidence, a sequence of events in the Grants area can be reconstructed (Table 1). Doubt as to the position of the sand dunes in the alluvial sequence and the difficulties involved in long range correlation with other sequences make this chronology tentative at best.

TABLE 1

PROBABLE SEQUENCE, GRANTS AREA

Time Interval			*Late Geologic Events in the Grants Area*	
7	11	Erosion	Present arroyo since 1885	Modern Dune Sand
6	10	Deposition	Alluvium on San José creek and upper part of "Late Alluvium" in Pumice Mine Arroyo	
5	9	———	———	Late Dune Sand
	8	Erosion	Cutting of gully in San José Creek	
4	7	Deposition	Late Alluvium	———
3	6	———	———	Old Dune Sand
	5	Erosion	Cutting of arroyo	
2	4	Deposition	Intermediate Alluvium	
	3	Erosion	Cutting of broad gully	
	2	Deposition	Early Alluvium (20-foot terrace)	
1	1	Erosion	Cutting of canyon in Laguna Flow	

It seems obvious that at Sites 2 and 9, the Old Dune Sand lies partly in the arroyo cut during Time Interval 5 in Table 1, and projects upward as a hill so as to be only partly buried by the Late Alluvium of Time Interval 7. For practical purposes the interval of erosion includes wind action and dune formation. Intervals 5 and 6 can be united. The Late Alluvium of Pumice Mine Canyon is dissected by the arroyo, but over the valley flat continues to be deposited even today. Presumably on San José Creek this formation was eroded and still later alluvium built up to form the flood plain, but Pumice Mine Arroyo spreads out in flats and appears to be obstructed by the lava flows so that it is less sensitive to change than the main stream.

Presumably, the Late Dune Sand falls in the postulated period of erosion later than the greater part of the Late Alluvium. The present arroyo of San José Creek, dissects alluvium which is taken to represent a third period of alluviation such as is expectable on streams of the region. Furthermore, the terrace on Pumice Mine Arroyo is not known to be older than the Intermediate Alluvium, nor has it been found on San José Creek. The Intermediate Alluvium may be merely the eroded portion of the alluvium that underlies the terrace. Events 1 to 4 may be

events 1 to 2. The eleven events may thus be reduced to seven, including the three periods of deposition and four of erosion shown in Table 2.

The sequence of alluviation and erosion in the Grants area is imperfect, involving the success of San José Creek in fighting or cutting a way through lava flows. McCartys Flow entered the San José Valley about six miles below the mouth of Pumice Mine Arroyo. This recent flow may easily have come into the valley within the past thousand years, and thus have interfered with the expectable sequence of events.

The sand dunes fall into a sequence and presumably correspond to three dry episodes as suggested for the Texas plains by Huffington and Albritton.[5a] Their contained artifacts also suggest that a fairly satisfactory correlation with the Big Bend region of Texas is possible as shown in Table 2. In Texas, the Maravillas complex is found on the unconformity between the Neville and Calamity formations and in the base of the Calamity. This complex contains points similar to the San José. The San José occurs in the weathered top of the stabilized Old Dunes, which occupy a place in the Grants sequence corresponding to the Neville-Calamity interval. As the dunes were complete at the time of occupation, the complex must have existed after the second period of alluviation had begun. In both areas, a complex similar in typology straddles the time boundary between erosion and alluviation. If we accept this correlation, then the Intermediate Alluvium at Grants occupies the same place in the sequence as the Neville formation, although it may not be equivalent in time.

The Late Dunes fall in the post-Calamity period of erosion. The Lobo artifacts at Site 7 and presumably elsewhere in the area, occur in the sand, not on its top. They are, therefore, of the same age as the Late Dunes. This period of wind action is thus of the same age or later than the associated Pueblo I pottery, 875 to 1100 A.D. The dates of this pottery and, therefore, of the Lobo complex correspond with the beginning of the Chisos and Livermore foci of the Texas area and confirm the geologic correlation. There are gaps both geological and archaeological in these sequences and in their correlation with each other.

The correlation of the Big Bend sequence and that of the Hopi country has already been made by Hack. By emphasizing the "break" or unconformity in the Tsegi formation and the permissive character of the evidence in Texas, the Calamity-Kokernot erosion may be dated as late as 1250 or 1300 A.D.

The correlation of the sequence in Whitewater Draw in southern Arizona with the sequence in the Big Bend region of Texas has already been made by Antevs.[6] Whitewater Draw drains the southern area of the

[5a] Huffington and Albritton, 1941. [6] Sayles and Antevs, 1941, pp. 39, 44; Kelley, Campbell and Lehmer, 1940, p. 157 and fn.

Sulphur Springs Valley through a broad axial flat between alluvium-covered pediments sloping from the west and from the east. A recent arroyo exposes sections of alluvium resting unconformably on a massive calichefied pinkish alluvium which resembles the Pliocene-Early Pleistocene, San Pedro Valley beds of the San Pedro Valley to the west. The alluvium consists of four more or less distinct bodies of alluvium separated from each other by erosional unconformities. The lowest body of alluvium consists of limonitic pebbly sand and gravel with transitions into well-laminated silts and sands and in one place a laminated clay. These beds are mostly the channel deposits of a stream, the predecessor of Whitewater Draw. The silts and laminated clay represent flood plains and flood plain ponds. These beds belong to a broad channel area and the simultaneously deposited beds of side streams are unidentified. The bones of mammoth (*Archidiskodon*), dire wolf (*Aenocyon*), and camel (*Camelops* near *hesternus*) are exposed. Here also are found artifacts of the Sulphur Springs stage of the Cochise culture.

The later beds are deposited in channels cut into the older beds but the form of these channels is apparently complex and so far unmapped. Resting on an unconformity cut on the lower beds of Sulphur Springs age lie the beds of fine sand, silt and sandy clay (cienega clay) in the form of channels. These beds contain a few fossils of modern mammals and artifacts of the Chiricahua stage. In a few places, artifacts of the San Pedro stage occur in the upper "cienega" clays. The latter complex is best known from old camp sites exposed on the surface by recent erosion of a few inches. It is also known from alluvial beds in San Pedro Valley.

Overlying these deposits and forming a thin skin over the flats adjacent to Whitewater Draw are beds of silt and fine sand. In these beds, light in color and referred to as the yellow silt, modern cow bones and also artifacts, including pottery dating from 1100 to 1400 A.D. have been found. It is fair to presume that the yellow silt was being deposited at the time the existing arroyo was cut, or at a time since 1885 A.D. It began to be deposited after 1100 A.D. It is, thus, approximately the equivalent of the Kokernot, although on the date given for the pottery, it began to be deposited a little earlier.

The erosion surface at the base of this silt is presumably a broad shallow channel corresponding in age, but not in form to the Calamity-Kokernot arroyo. The Calamity and Tsegi formations in a few places show an unconformity between a lower and upper section. This unconformity recorded by Albritton and Bryan and by Hack is difficult to trace and geologically seems to have minor significance. It is, however, fairly well-marked on Whitewater Draw and separates the beds containing artifacts of the San Pedro and Chiricahua stages. If these beds are

correlated with the upper and lower portions of the Calamity and Tsegi formations the Chiricahua stage (with its accompanying two serrated points) becomes equivalent to the Santiago and Maravillas complexes, and to the San José complex. Such an arrangement meets the known geological facts. It does not imply that the people who made the points were the same or even that the points are typologically identical. It merely implies rough contemporaneity in time and that the serrated point was a style of point widespread in the Southwest.

The Maravillas and presumably the San José began in the erosion interval previous to the Lower Calamity. Sayles implies that the Chiricahua had such a distribution in time but of this there is no tangible proof.

The relative position of the Neville and Jeddito formations, of the Intermediate Alluvium in Pumice Mine Canyon and of the beds containing the artifacts of the Sulphur Springs stage is the same. They are all older than a marked unconformity which separates them from younger beds. This unconformity was produced by the erosion of a broad gully and wind action was strong—much stronger than it has been since. Whether these beds are contemporary with each other is an unsolved problem. The foregoing facts taken with sporadic occurrences of extinct animals indicate that they all have an antiquity greater than the introduction of serrated points. Beyond this inadequate conclusion, the existing facts permit only speculation which seems out of place here.

The geologic sequence at Grants is incomplete. The Old Dunes in places lie in a gully and are overlain by alluvium in part dissected. Elsewhere, the Old Dunes are overlain by more wind-blown sand, the Late Dunes and the Modern Dunes. On the weathered and stabilized surface of the Old Dunes the people responsible for the San José complex camped. While the Late Dunes were forming, the people responsible for the Lobo complex camped on them. Pueblo stone artifacts and pottery of Pueblo I date were simultaneously deposited.

This incomplete sequence may be correlated with the sequences in Texas and Arizona. From this correlation it appears that the San José complex is presumably equivalent in time to the Maravillas and Santiago complexes of Texas and with less surety to the Chiricahua stage of the Cochise culture in southern Arizona.

The alluvial chronology has been expanded by the work in the Grants area and the erosional break in the third period of alluviation represented by the Calamity and Tsegi formations appears to be of greater consequence than heretofore perceived.

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June, 1942

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FACTS AND COMMENTS

A DATED SILT DEPOSIT IN THE OCMULGEE RIVER VALLEY, GEORGIA

During the early fall of 1941, excavations were made by the National Park Service at the Lamar site, Bibb County, Georgia, on the ground of the proposed south section of the levee which will surround the site. The area was formerly forested and is level, poorly drained, and subject to frequent flooding by the Ocmulgee River. Elevation varies little in the river valley; in the section trenched, it ranges between 276.4 feet and 278.9 feet. The occupation area of the Lamar site lies on slightly higher ground with a maximum height of 282 feet (exclusive of the mounds). The surface soil of the bottom land, including the Lamar village site, is Congaree Silty Clay Loam, a recent alluvial deposit of the Ocmulgee River.[1]

Jennings has demonstrated that the small rise, at the time of occupation by the Lamar group, was an erosional remnant of Eocene clay surrounded by river swamps.[2] The site is now silted over and is part of the flood plain of the Ocmulgee River. Jennings was concerned with the length of time involved in the change from island and swamp condition to level river terrace land. From interpretations of the profiles of a drainage ditch made by whites and tabulations of flood occurrences, he estimated a period of not more than one hundred years. The purpose of this note is not to disagree with Jennings, but to establish an even more definite date.

Three major soil horizons are present: the bottom one is the erosional remnant, a sandy red clay identified as Greenville Sandy Loam; the second is a steel-grey, mucky clay, grading gradually into grey sand, identified as Grady Clay merging into Grady Sandy Loam; the third is a tan silt identified as Congaree Silty Clay Loam. The Grady series overlaps the Greenville and the Congaree silt overlies both. Leaching has noticeably affected the Grady and Congaree soils. The upper six to twelve inches of the grey clay and sand show only occasional iron stains while the lower levels are highly colored by bright yellow iron stains. Apparently, when the grey clay and sand composed the top formation, a leaching process dissolved the iron from the upper levels and concentrated it in the lower. The Congaree Silt is being subjected to the same process; the upper twelve to twenty-four inches of silt are a light tan while the lower levels are much darkened by iron stains and concretions. The silt appears to have been deposited so rapidly that the iron-impregnated water has not had time to redeposit iron in the upper levels of the relatively more impervious clay.

The top levels of the Grady Clay and Loam have many inclusive sherds of the Lamar types and very occasional sherds of the St. Simons Fibre Tempered and Macon Plateau types. Often sherds of the same vessel are found lying together as if they had been thrown there as refuse, indicating that the artifacts were not deposited by erosional processes and that the upper levels of the Grady formation were being put down at the time the Lamar village was occupied. The Congaree Silt contains only occasional sherds; those at the very bottom possibly were deposited at the time of occupation; those found in sand lenses in the silt are present there as a result of recent erosion of the higher village deposit.

Profiles were made across a drainage ditch which was occasionally visible as a depression, approximately six inches below the general land level, bordered by ridges of spoil dirt approximately six inches above the general level. The initial excavation of this

[1] Phillips, S. W., A. H. Meyer, Mark Baldwin, and J. W. Moon, *Soil Survey of Bibb County, Georgia*, U. S. Department of Agriculture, Bureau of Soils, G. P. O., 1926, p. 1117.

[2] Jennings, J. D., "Recent Excavations at the Lamar Site, Ocmulgee National Monument, Macon," *Proceedings of the Society for Georgia Archaeology*, Vol. 2, No. 2, 1939, p. 52.

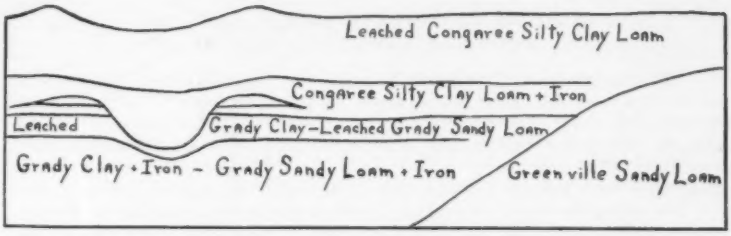
Leached Congaree Silty Clay Loam
Congaree Silty Clay Loam + Iron
Leached
Grady Clay–Leached Grady Sandy Loam
Grady Clay + Iron – Grady Sandy Loam + Iron
Greenville Sandy Loam

FIG. 27.—Composite profile under south section of Lamar levee, Georgia.

ditch[3] had penetrated into the iron-stained Grady Clay and the resulting spoil dirt had been thrown out to each side. This spoil dirt was easily recognized as lens-shaped inclusions of steel-grey Grady Clay in the brown Congaree Silt. Secondary leaching of the Grady iron-stained clay took place while the ditch stood open, so that there was a broad U-shaped dip of leached clay under the ditch bottom. Obviously, the initial excavation of the ditch was made at a time when only four to six inches of Congaree Silt had been deposited and twenty-four to thirty inches of silt have been laid down since.

George White,[4] writing in 1849 and describing the mounds about Macon, says:

> The two on Mr. Lamar's plantation have had the forest growth recently cleared from around them, and present a very distinct outline of the circumvallations and other such works connecting them.

It seems highly probable that drainage was provided for at the time of clearing and that the ditch dates from a period between 1840 and 1848. The *Soil Survey of Bibb County* in describing the Congaree Silt says that "most of it could be cleared and farmed with profit if drainage ditches were dug."[5] This could easily apply to the situation in the 1840's.

The Lamar group possessed a culture related to that of the historic Creek group living at Ocmulgee Fields between 1686 and 1717. It is believed that the Lamar Indians were of the type visited by De Soto in Georgia and were immediately ancestral to the historic Creeks. The sherds in the upper Grady Clay, and the clay itself, would date roughly from 1650. This indicates that during a period of approximately two hundred years (1650–1840) only four to six inches of silt were deposited, while during the next approximate one hundred year period (1840–1941) twenty-four to thirty inches were laid down. The process of leaching has progressed rapidly in this recently deposited Congaree Silt, the upper twelve to twenty-four inches being relatively free from iron. In the relatively more impervious clay, staining as a result of leaching of the overlying silt has not yet become complete.

The heavy silt deposition, with associated heavy erosion, is undoubtedly correlated with intensive cultivation in central Georgia, and is a demonstration of the rapidity with which relatively recent cultural remains may be buried beneath a deep overburden. Also indicated is the small time period necessary for the formation of a leached soil profile.

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[3] Evidence of re-opening of the ditch need not be discussed, as re-opening did not affect the situation presented.

[4] White, George, *Statistics of the State of Georgia*, W. Thorne Williams, Savannah, 1849, pp. 113–14.

[5] Phillips, S. W., A. H. Meyer, Mark Baldwin, and J. W. Moon, *op. cit.*, p. 52.

SOME EARLY TYPES OF POINTS FROM THE LOWER YELLOWSTONE COUNTRY

The projectile points described below are surface finds discovered by Oscar Lewis within a few miles of his ranch located about twenty miles south of Glendive, Montana. As some of the types represented are those which have been found to have considerable antiquity elsewhere and the complex is similar to that recorded in Pictograph Cave I, a cultural horizon buried under two other prehistoric and one historic horizon at Pictograph Cave[1] near Billings, Montana, their occurrence in this locality is of interest.

The area in the vicinity of the Lewis ranch is, like much of this part of Montana, markedly rolling in character, being broken by frequent extensive outcroppings of Lance and Fort Union sandstone, which are separated by broad bottoms of deeply bedded alluvium. The bottoms have recently been deeply and intricately dissected by stream action in this locality, exposing in the newly cut banks an enormous number of small fire sites at depths varying from ten to twenty inches. These are widely dispersed throughout the whole area and seem not to occur in large concentrations. The points described were found in association with and in the vicinity of these many hearths.

The area appears to be remarkable, not only for the variety of early types represented, but for the comparative absence of the side-notched concave-base projectile points and the large corner-notched convex-base points which, in Pictograph Cave, have been demonstrated to belong to later horizons.[2]

There are thirty-six points and a large number of less easily identifiable fragments. Figure 28, Nos. 1–9 are typical Oblique Yumas[3] with smoothed bases and the characteristic excellent flaking. Nos. 12, 13 are typical stemmed Yumas, although the flaking is not quite of the true Collateral type, inclining more toward the Indeterminate.[4] Nos. 10–11 seem to be similar, but are of a slightly divergent shape. All have slightly smoothed bases.

Nos. 14, 15 are concave-base unnotched blades which are interesting particularly because of the excellent flaking which is similar to that on Oblique Yumas. Each is slightly smoothed on either side of the base.

Nos. 16–19 are of a rather stylized type which appears to have some antiquity as it occurs in Pictograph Cave I in association with Collateral Yumas. Similar points are found in Signal Butte I.[5]

Nos. 20–26 also seem to be of an early type for they too are found in Pictograph Cave I and are similar to points from Signal Butte I.[6] The sides of the bases are characteristically slightly smoothed.

Nos. 27–33 are points of undefined cultural associations which are shown because they occur in the same locality as the others. They do not seem to conform to any of the highly stylized types which have been identified with later prehistoric manifestations in this region.

Nos. 34–36 are Folsom points. Each has a longitudinal flake removed from each face and they probably most closely approach the Generalized Folsom[7] type. In only one case, No. 34, are the sides of the base slightly smoothed.

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[1] Mulloy, "Some Ancient Caves in the Central Yellowstone Valley." Unpublished Ms. in the files of the Montana Archaeological Survey.a [2] *Ibid.*

[3] Wormington, H. M. *Ancient Man in North America.* Popular Series, Colorado Museum of Natural History, No. 4, 1939, p. 24. [4] *Ibid.*, p. 29.

[5] Strong, William Duncan. *An Introduction to the Study of Nebraska Archaeology.* Smithsonian Miscellaneous collections, Vol. 93, No. 10, pl. 25-I-c.

[6] *Ibid.*, pl. 25-I-d.

[7] Wormington, *op. cit.*, p. 29.

Material is surprisingly uniform. Nos. 1, 4, 7–9, 11–16, 18, 19, 21, 23–27, 29, 31, and 36 are brown to buff flint, usually heavlly patinated. Nos. 2–4, 6, 17, 20, 28, 30, 31, 33

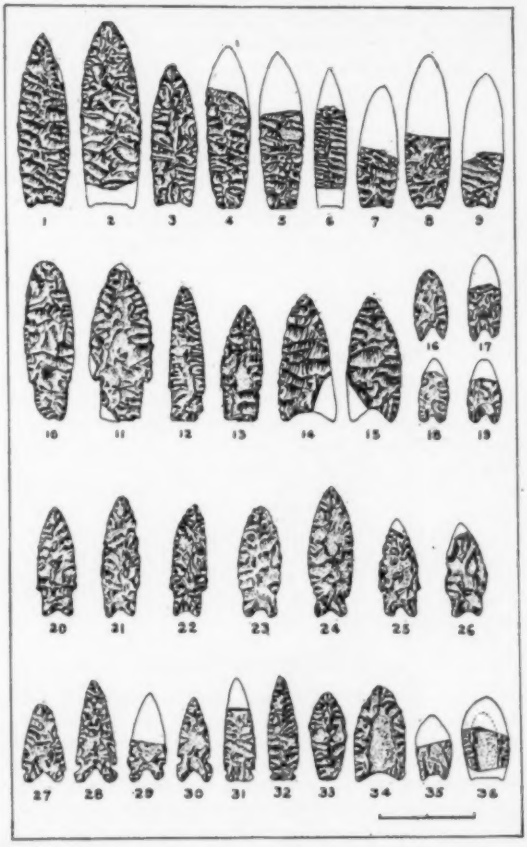

FIG. 28.—Early types of points from the lower Yellowstone Country.

and 34 are red or grey chert. Nos. 10 and 35 are quartzite. All of these materials are plentiful in the region.

It is suggested that an extended, intensive investigation of this locality by an institution with the necessary facilities would probably yield significant information.

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NOTES AND NEWS

A NEW SITE

An interesting site in the Agate Basin, on a tributary of the Cheyenne River midway between Newcastle and Lusk, in eastern Wyoming, was prospected and tested during the month of July, 1942, by Dr. Frank H. H. Roberts Jr., Bureau of American Ethnology, Smithsonian Institution. The site appears to be the remnant of a bison kill on the edges of a marsh or meadow. At present the bone-bearing stratum breaks out of the bank some 20 feet above the bottom of a slowly-eroding gully. It is covered by an overburden that deepens rapidly as the layer is followed back into the bank and at a depth of 4 feet, as far as the tests were carried, was still continuing. Associated with the bison bones are points that suggest an affinity with the Collateral Yuma type but do not have all of the characteristics of that form in its perfected state. Numerous people have unhesitatingly called them Yuma as soon as they have seen them, however, and there is no question but that they belong in that general category. All of the points found at the site are consistent in pattern, although there is considerable range in size. In the 70-odd points or large and easily identified fragments recovered there, no shouldered, barbed, or tanged forms appear. The material appears to represent a cultural unit. Dr. Roberts dug 32 examples out of undisturbed deposits. The remaining specimens are in collections of local residents,who picked them up as they weathered out of the gully bank. A few end and side scrapers have been found. Inasmuch as the camp proper has not yet been located, only the scene of the kill being known, these implements are in a small minority. They are typical of those associated with the so-called early hunting complexes, however. Geologic studies of the deposits have not yet been made, but they indicate some antiquity. That they are not as old as the age usually postulated for Yuma remains is demonstrated by the fact that the bison represented are all modern forms. In a large quantity of bones examined, not one was from an extinct species of animal. It is hoped that when present conditions are over, the site can be thoroughly excavated and detailed studies made of the material. The site was found by William Spencer of Spencer, Wyoming, and was reported to the Smithsonian Institution by Robert E. Frison, Deputy Game Warden, Wyoming State Game and Fish Commission, of Newcastle.

INTER-AMERICAN SOCIETY

An Inter-American Society of Anthropology and Geography will be founded January 1, 1943. Its objectives are: 1, the interchange of information and views among scientists interested in the cultures of the Americas; 2, the formulation of research problems and the development of scientific methods and objectives in anthropology, geography, and related social science research in the Americas; 3, the promotion of Inter-American cooperation in these fields; 4, the encouragement of publication.

The Society will publish a quarterly review, the first issue to appear early in 1943. The review will carry articles which have subject matter or method of broad Inter-American rather than local interest. It will publish summaries of recent work in areas or countries, discussions of research problems, abstracts of outstanding recent works, and notes of news of personal and institutional activities. Publication will be primarily in English, Spanish, and Portuguese, but contributions in other languages may be accepted.

A Temporary Organizing Committee has undertaken to establish and conduct the affairs of the Society until it can be put on a permanent basis. This has been necessary because an organization meeting cannot be held at this time and because the Smithsonian Institution has provided special facilities to assist in the preliminary work. This Com-

mittee consists of Wendell C. Bennett, Yale University; George Vaillant, University of Pennsylvania Museums; Preston James, University of Michigan; Julian Steward, Smithsonian Institution; Carl O. Sauer, University of California; S. W. Boggs, State Department; and Ralph L. Beals, on leave from the University of California, now at the Smithsonian Institution. This Committee will function until December 31, 1944, when elective officers will assume control.

Temporary Statutes have been adopted to govern the Society until permanent Statutes can be adopted at a regular meeting, which may be held in conjunction with the next American Scientific Congress.

The Temporary Organizing Committee invites the membersip of interested individuals, societies, and institutions. Regular membership is open to individuals upon payment of dues of $3.00 a year. Students who submit a statement of status signed by two instructors, may become Student Members for three years, at a special rate of $2.00 a year. Organizations and institutions may become Affiliated upon payment of $3.00 a year. Applications for Membership, accompanied by dues for the first year, may be sent to Ralph L. Beals, Smithsonian Institution, Washington, D. C. Contributions for the Review may be sent to the same address.

COMMITTEES APPOINTED BY THE PRESIDENT

Following provisions in the Constitution the following committees have been appointed by the President.

Budget Committee

N. C. Nelson, Waldo R. Wedel, Frederick Johnson, Douglas S. Byers, Glenn A. Black, Harold S. Colton, Charles Keyes and Cornelius Osgood.

Auditing Committee

J. O. Brew, Chairman, Leaman F. Hallett and Lauriston Ward.

Nominating Committee

George C. Vaillant, Chairman, F. H. H. Roberts, Wendell Bennett.

Program Committee

F. M. Setzler, Chairman, Waldo R. Wedel and H. B. Collins.

ANNUAL MEETING

In compliance with the request of the Coordinator of Transportation that scientific societies not directly connected with the war forego their usual meetings, the Society for American Archaeology will hold only a small business meeting. At this meeting, the election of officers will take place, and the annual reports will be presented. The meeting will probably be held in New York because of the ability to assemble a quorum, and the availability of accommodations. The date will probably be during the latter part of May.

Robert Wauchope, Director of the Middle American Research Institute of Tulane University, announces a new series, "Middle American Research Records," to consist of short articles, separately published, for which a binder is available. Three numbers have already appeared.

Field Museum of Natural History, Chicago, opened the first section of the Hall of New World Archaeology on January 25. A few significant specimens, selected to illustrate the characteristics of each area, are displayed, instead of the long rows of objects formerly on exhibition.

BOOK REVIEWS

The Association of Archaeological Materials with Geological Deposits in the Big Bend Region of Texas. J. CHARLES KELLEY, T. N. CAMPBELL and DONALD J. LEHMER. (Sul Ross State Teachers College Bulletin, Vol. 21, No. 3, pp. 1–173, 20 pls. 8 figs. Alpine, Texas, Sept. 1, 1940.)

Many attempts have been made to correlate the archaeological cultures in the Big Bend region of southwestern Texas. Until 1938, investigations were limited primarily to the human deposits in caves and rock shelters. These cave cultures, related to each other in a general way, were subdivided into the Pecos River focus and the Chisos focus—the eastern and western part of the Big Bend. Surface surveys and limited excavations around Presidio, Texas, indicated pottery-using people centering near the junction of the Conchos and Rio Grande and extending roughly from Presidio to El Paso, Texas.

In 1938, the Sul Ross State Teachers College at Alpine, Texas, in cooperation with the Peabody Museum of Harvard University made it possible for the authors of this publication to investigate a new approach which might lead to a solution of the Big Bend problems. The fundamental questions are: (1) Who were the Big Bend cave dwellers? (2) What is the relation of cave cultures to other archaeological manifestations in Texas or neighboring states? (3) Are there any unrelated complexes preceding the cave dwellers? (4) What is the relation of the non-pottery-makers to the more sedentary people who lived along the banks of the Rio Grande?

By limiting their archaeological investigations to open sites discovered in the banks of various creeks, especially in such formations as had been studied intensively and during the same year by Claude C. Albritton, Jr., and Kirk Bryan, the authors successfully collected evidence which has contributed toward the solution of these problems.

To fully appreciate the significance of these combined geological and archaeological studies one must use the results published by Albritton and Bryan.[1]

After reading the publication here reviewed, one realizes the amount of strenuous digging required to obtain the limited number of stone specimens. The publication is divided into three parts: Part I, "Introduction," by Kelley, lists the various traits associated with caves and rock shelters, known as the Pecos River and Chisos foci; the Bravo Valley aspect associated with protohistoric and historic groups centering near the junction of the Conchos and Rio Grande; and the recent semi-nomadic groups. Part II, "Activities and Findings of the Expedition," by Campbell, Kelley and Lehmer, describes the exploration of open sites in the recent quaternary alluvial deposits. Part III includes summary, comparisons, discussions and conclusions, by Kelley and Campbell. All sections are illustrated; diagrams, sections and correlation charts assist in clarifying results.

The stratigraphic levels of the archaeological deposits are based on the identifications made by Albritton and Bryan, who conclude that the open valleys in this part of the Big Bend are essentially eroded surfaces veneered by quaternary alluvial deposits. This alluvium is divided into three main bodies, the oldest termed Neville, the middle one Calamity, and the most recent or youngest, Kokernot. They conclude that each division represents a climatic change. The Neville deposition occurred during a period of humid climate, and because of its depth, represents a much longer span of time than any of the later formations. No evidence of man was found in the Neville deposits, yet they do contain the bones of extinct mammoths and horses. A change in climate caused considerable erosion in the Neville deposits. A return to a more humid climate accounts for

[1] "Quaternary Stratigraphy in the Davis Mountains, Trans-Pecos Texas." (*Bulletin of the Geological ociety of America*, Vol. 50, pp. 1423–1474, 1939.)

a depositional period which filled the deep channels cut at the end of the Neville and regarded as the Calamity division. It is during this depositional period that evidence of man first appears. The very limited lithic material recovered from this formation is classified as the Maravellas complex. The archaeological material had apparently been washed into position, but, because it was concentrated, the authors conclude that its original source was not far away. They interpret the stratum as basically reworked Neville material. This complex consists of 2 projectile points, 2 knives, 10 scrapers and several retouched flakes, 2 choppers, 3 hammerstones, 13 manos (2 deliberately shaped), 4 fragments of metates, and 6 miscellaneous cores and flakes. The authors realize that this is a very small amount of material on which to establish an archaeological complex. If they are correct in assuming that this small pocket of artifacts, even though removed from its original position, belongs in the lowest level of the Calamity formation, then it constitutes the earliest evidence of man thus far recovered in the region. From a generalized point of view the reviewer would combine all evidence of man in the Calamity formation as a part of the Big Bend aspect without attempting to make too many minor variations on the basis of the few lithic specimens recovered.

There is no doubt that the people responsible for the cave cultures lived in open sites on the surface of the then exposed land formations. They also buried their dead in the ground as well as in the caves. Whether the change in climate from a humid to arid condition drove them into the caves, or vice versa, cannot be ascertained. Since the open sites produced only lithic material, all of the more diagnostic perishable elements, such as baskets, sandals, etc., are of no value for comparative purposes. The authors were forced, therefore, to rely on two projectile points as their most valuable traits of comparison.

The old creek channels which were eroded during the Neville period were refilled during the Calamity period. The climate again changed and once more erosion set in and scoured out the alluvial material deposited in the same old channels, but not as deep as during the end of the Neville period. Another change in the climate from arid to humid caused a second refilling of the old channels, termed the Kokernot. A third cycle of channeling is represented by the present arid climate, in which the Kokernot deposits are being eroded. Material recovered in and on this last formation, the Kokernot, is classified as the Bravo Valley aspect, in which El Paso polychrome pottery is associated. The sherds recovered have been dated roughly around the thirteenth century A.D. Evidence of the Chisos focus of the Big Bend aspect was also identified from the Kokernot formation.

The authors think the specimens from the Chisos Mountains caves are unrelated to cave materials from the Pecos River. They make a comparison with the lithic material from the late Edwards Plateau horizon and conclude that the cave culture from the Chisos Mountains, together with the lithic material from their open sites in the Kokernot formation, represents a migration of the late Edwards Plateau people from central and eastern Texas to the Chisos and Davis Mountains (p. 162). My own surmise would be that if the Chisos focus is later than the Pecos River focus, the people who inhabited the caves in the Chisos Mountains and around Alpine belonged to the same physical and cultural groups as those inhabiting the caves along the Pecos River.

The people responsible for the Livermore focus certainly made a type of projectile point entirely different from those associated with any of the cave cultures. Since the same characteristic type of Livermore projectile point is associated with the Bravo Valley complex, there seems every reason to conclude relationship, and, on the basis of other material traits recovered near Presidio, its makers would represent a cultural group unrelated to the cave dwellers. Since objects comparable to the Chisos and Livermore foci were found on separate sites in the erosional stage between the Calamity and modern Kokernot formations, they are regarded as contemporaneous. In a forthcoming publica-

tion, Kelley will describe this entire Bravo Valley aspect with its historical tie-ups and intrusive pottery from certain pueblo groups dated from about 1200 to 1800 A.D.

Though the many pertinent details are well organized, this report is somewhat difficult to digest. The photographic illustrations could be improved, numerous errors in printing detract, and a more detailed table of contents would enable one to check various points much easier. The authors, however, are not to blame, and these minor distractions do not minimize the contribution they have made to Big Bend archaeology.

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The Boylston Street Fishweir. A Study of the Archaeology, Biology, and Geology of a Site on Boylston Street in the Back Bay District of Boston, Massachusetts. FREDERICK JOHNSON in collaboration with HENRY C. STETSON, FRANCES L. PARKER, WILLIAM J. CLENCH, THURLOW C. NELSON, DAVID H. LINDER, IRWING W. BAILEY, ELSO S. BARGHOORN, EDWIN C. JAHN, WILLIAM M. HARLOW, WILLIAM S. BENNINGHOFF, ARTHUR S. KNOX. (Papers of the Robert S. Peabody Foundation for Archaeology, Vol. 2, pp. xii+212, 14 plates, 16 text figures, Phillips Academy, Andover, Mass., 1942.)

The Boylston Street (Boston) Fishweir is an ancient structure of upright wooden stakes, interlaced with horizontal brush. It was probably used to catch fish (pp. 10, 206). The weir was discovered in a tunnel excavation in 1913, and was exposed in 1939 during the excavation for the foundation of the New England Mutual Life Insurance Company's building. It was buried beneath 12.5 feet of silt and 18 feet of modern fill. The significance of the weir was discussed by H. W. Shimer in 1918 and by C. C. Willoughby in 1927. The present study includes examination of sediments and contained fossils by eleven specialists and is probably the most thorough and manysided investigation of a find pertaining to prehistoric man in America.

The exposed part of the fishweir is composed of about 65,000 stakes placed in "walls" and "areas of concentration," distributed over an area of more than two acres (pp. 1, 24). The six known walls vary in width from two to ten feet. Four of them are over 300 feet long and run, approximately parallel, north and south. Secondary walls and branches run mostly northeast and southwest. Frequently, four to eight stakes, trimmed of branches and with one end crudely sharpened, were driven in a group covering about one square foot. The stakes are frequently about one inch in diameter; but some stakes measure as much as four inches. They are from two to five feet long and were driven down to different depths. The height of the tops varies only 11 inches, but the stakes were originally longer and have been cut off, perhaps scoured off at the mud line (pp. 29, 35, 37). The horizontal brush, or wattling, consists of branches and shrubs pushed down among the stakes. Rarely does the arrangement suggest weaving (p. 27). The brush is concentrated at two levels.

In the building excavation the following beds were encountered (p. 12):

At top, *h:* 18 feet of modern fill.
g: 4 inches salt water peat, Upper Peat.
f: 15.5 feet salt water silt. This silt contains the Shell Layers 1, 2, and 3 at depths in silt of about 14, 13, and 6.5 feet; an oyster bed at from 13 to 9 feet; and the fishweir from the depth of 12.5 feet down through the underlying peat.
e: 9 inches peat, Lower Peat, the lower part deposited in fresh water, the upper part in increasingly saltier water (pp. 80, 149).
d: 7 feet blue marine clay with warm foraminifera (pp. 22, 42, 141, 149, 181).

c: 5 feet firm yellow clay.
b: ca. 60 feet soft blue clay.
a: ca. 35 feet cemented clay and gravel resting upon bedrock, slate.

The yellow tint of bed *c* is believed to be a result of oxidation (pp. 22, 142, 149); and this would suggest that the clay was exposed to the air prior to the deposition of the overlying bed. The fine texture of the top clay, bed *d*, together with the contained foraminifera suggest deposition in water that was at least 500 feet deep and warmer than the present water of Massachusetts Bay (Stetson & Parker, pp. 42, 43). On the stream eroded surface of this deep water clay there is fresh water peat. The required minimum of events—emergence for oxidation, deep submergence for deposition of the blue top clay, and emergence for stream erosion and formation of the fresh water peat—is more than can well be accounted for in late glacial and post-glacial times. The clay bed *d* is interglacial in the reviewer's mind, erosion having removed the deposits of the last glaciation prior to the formation of the Lower Peat.

Between the blue clay and the Lower Peat there is consequently a big gap. Stream erosion shaved off the clay until peat began forming shortly before submergence of the level, which took place about the middle of the Post-glacial. The pollen grains in the Lower Peat perhaps indicate a somewhat drier climate than now prevails (Benninghoff, p. 104). The frequency of the pollen of the rarer tree species decreases from the peat upward in the overlying silt suggesting that a temperature decline set in soon after or during the formation of the Lower Peat (Knox, p. 124). This decline was interrupted by a slight rise during the formation of Shell Layer 2, but subsequently the temperature fall was marked (p. 124).

The mollusks, which are vertically distributed from a sand layer in the Lower Peat upward into the topmost Shell Layer 3, indicate that the water was warmest during the formation of Shell Layer 2 (Clench, p. 47). It was then surely warmer than today; and it was possibly also warmer during the deposition of the underlying silt. During the formation of the Oyster Bed the water may have remained warmer than today (p. 184); but during the age of Shell Layer 3 it was cool (p. 48).

The large colony of *Balanus eburneus* on the fishweir stakes and the barnacle fragments in Shell Layer 1 (pp. 16, 182), suggest slightly warmer water than at present (Lindquist, p. 66). Marine borers (*Bankia gouldi*) in the stakes indicate considerably warmer water prior to the formation of Shell Layer 2 (Clapp, p. 130; p. 182). The diatoms in the topmost part of the Lower Peat suggest warmer water than today, while those in the overlying silt show entry of colder and saltier water with a brief interlude of warmer water during the formation of Shell Layer 1 (Linder, p. 80).

The Upper Peat may have been formed in a shallow, fairly protected bay of the ocean, in water which judging by the diatoms was warmer than that of today (Linder, pp. 79–80). The deposition occurred prior to European colonization (p. 184).

Thus the land and sea biota suggest higher temperature or warmer water than today from the beginning of deposition of the oldest post-glacial bed present, the Lower Peat, to about the end of formation of the Oyster Bed. The air temperature seems to have been highest during (or prior to) the age of the Lower Peat, while the water was warmest during and prior to the age of Shell Layer 2, i.e. exactly during the time of operation of the fishweir.

In the final dating of the fishweir, Johnson primarily employs Knox's and Benninghoff's studies of the tree pollen and gives, with reservations, their correlations of the beds with the dated post-glacial climatic ages in Scandinavia (pp. 191–192). Knox stresses the close parallelism, indicated by the peat profiles, between the late glacial and post-glacial climatic evolutions in New England and in Scandinavia (pp. 121–124). He is inclined to

believe that the climatic ages and changes here and there were not only comparable but synchronous; and he specifically assumes that this holds for the change from dry and warm to wet and cool which occurred at the end of the Sub-Boreal age (pp. 125–126). Knox dates this transition at about 1200 B.C., and believes that it is recorded by the change in the peat at the six-foot level in the Willington Marsh (pp. 111, 112, 126). Then, by correlation of the pollen profiles from this marsh with those from the excavation on Boylston Street, he arrives at the conclusion that the fishweir was in use during the Sub-Boreal, between 1700 and 1400 B.C. This is one of the ages Johnson gives with reservations (p. 192). If Knox had started from the Swedish date of the transition from the Sub-Boreal to the Sub-Atlantic which is 600 B.C.,[1] he would have dated the fishweir at 1100–800 B.C. However, neither date of the fishweir fits well, for, as far as known, the age 1700–800 B.C. was in Sweden no warmer than the present, whereas the weir was operated during a distinctly warmer age.

From the relatively static vegetation composing the Lower Peat and its similarity with that of eastern Massachusetts at present, Benninghoff concludes that this peat was formed during the late Sub-Boreal or the early Sub-Atlantic (p. 104). It follows that the fishweir would be of early Sub-Atlantic age (p. 192). However, this age was especially cool in northern Europe.

A general correlation between the comparable late glacial and post-glacial climatic ages in New England (or in the mid-western States) and in Sweden, which is commonly made in America, cannot be right. Peat began to form in America as well as in Sweden directly or almost directly upon the release from the last ice sheets, though remains of a tundra flora at the bottom of the bogs are rare both here and there.[2] This is dawning upon at least some American paleobotanists.[3] Thus, peat began forming in southern New England roughly 30,000 years ago, in central Sweden about 10,000 years ago. The comparable climatic evolutions in New England and in Sweden, therefore, occupied very different lengths of time, ages as 3 to 1, and the *early* similar climatic ages were *not* synchronous.

The climatic factor suitable as a basis for long-range correlation is the great, slow change in summer temperature.[4] Precipitation, though very useful within a limited region, is incompetent for long-range correlations, for, since the total precipitation on the earth varies little from year to year or from age to age, an increase in one region is compensated by a decrease in another.

In Sweden the period between 6000 and 2000 B.C. was decidedly warmer than the present.[5] The highest temperature prevailed about 4000 B.C. During its subsequent drop the temperature reached the modern level at roughly 1800 B.C., and fell decidedly below it, perhaps by 1000 B.C., or anyway about 600 B.C. This warm age, 6000–2000 B.C., may serve as basis for trans-atlantic correlation; and the warmest (dry or moist) post-glacial age in America may be dated at roughly 6000–2000 B.C. Since, in the Boylston Street sediment section, both land and sea biota suggest that the temperature dropped to the mod-

[1] Granlund, Erik. "De svenska högmossarnas geologi," *Sveriges Geologiska Undersökning*, Ser. C, No. 373 (Årsbok 26) Stockholm, 1932. See pp. 169, 171. (Temperature and precipitation curves are reproduced in Medallion Papers No. 26, p. 73, Globe, Arizona.)

[2] For Sweden see: Magnusson, Nils, and Erik Granlund, *Sveriges geologi*, pp. 236–239. Stockholm, 1936.

[3] Deevey, E. S., Jr., "Studies on Connecticut Lake Sediments," *American Journal of Science*, Vol. 237, pp. 691–724, 1939. See pp. 714, 720.

[4] Antevs, Ernst. "Correlations of Late Quaternary Chronologies," *Report of 16th International Geological Congress*, Washington, 1933, pp. 213–216. Washington, 1936.

[5] See footnotes 1 and 2.—von Post, Lennart. "Den svenska skogen efter istiden," *Verdandis Småskrifter*, No. 357, Stockholm, 1933, see pp. 57–59; Fromm, Erik. "Geochronologisch datierte Pollendiagramme und Diatomeenanalysen aus Ångermanland," *Geologiska Föreningens i Stockholm, Förhandlingar*, Band 60, häfte 3, No. 414, pp. 365–381, 1938. See pp. 379–380.

ern level shortly after the formation of Shell Layer 2, the termination of this layer may be dated at about 2000 B.C. According to this correlation, the fishweir would have been in operation during the centuries preceding 2000 B.C.

The post-glacial beds, their fossil contents and present position in relation to sea level clearly show that the Boston region has been submerged, has suffered transgression. The submergence began prior to the formation of the Lower Peat, and, according to some investigators, the process is still going on, while, according to others, it stopped two or more thousand years ago (p. 177). Johnson makes a strong effort to use the changes of level for dating the fishweir, but wisely gives up the attempt in the face of scanty data, too many possibilities, and seemingly contradictory evidence (p. 178). Rather, the investigations contribute to the knowledge of the changes of level. The Lower Peat at the excavation has been submerged about twenty-nine feet (p. 161). If Shell Layer 2 was formed at low tide level, as is probable (pp. 46, 163–165), the shoreline stood 13.5 feet lower than at present when the fishweir was abandoned about 2000 B.C.

But the Boston fishermen were probably not the first immigrants to New England, for an 1884 a human skull and a mastodon skull were found at the base of a peat deposit near Worcester.[6] Therefore, at the same time as we compliment Johnson and collaborators on the present excellent monograph, we express the hope that new finds will enable them to report on still earlier man in New England.

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A Reconstruction of Uto-Aztecan History. ROBERT M. ZINGG. (Contributions to Ethnography, Vol. 2, University of Denver, pp. 274. G. E. Stechert & Company, New York, 1939.)

Report on the Archaeology of Southern Chihuahua. ROBERT M. ZINGG, with Appendix on Cave Dweller Twill-Plaited Basketry by Miss Gene Weltfish. (Contributions of the University of Denver, Vol. 3, Center of Latin American Studies, Vol. 1, pp. 95. 1940.)

In the first of these volumes, Dr. Zingg has given the evidence for an "hypothesis as to certain features of the cultural development of the Uto-Aztecan peoples by correlating modern ethnographical cultures with certain archaeological remains of the Uto-Aztecan region." In brief outline, his hypothesis is this:

The Uto-Aztecan peoples, having passed south from Behring Strait, entered an area already occupied by people with a Basketmaker I culture and took over that culture from them. This substratum of Basketmaker I culture in the Great Basin and California regions persisted to modern times where it may be seen in the cultures of the Shoshonean "digger" Indians. In the region of the Four Corners—where Arizona, Utah, Colorado, and New Mexico meet—the Basketmaker I Uto-Aztecans were freed, by the introduction of corn agriculture, to elaborate their culture through subsequent stages culminating in the modern Puebloan Hopi. Southern migrations of Uto-Aztecans with their Basketmaker I, "proto Uto-Aztecan" culture, proceeded into Mexico; thus there are indications of Basketmaker affiliations for the Pima and Papago. Modern Sonoran Uto-Aztecan culture is the result of this drift of the proto-Uto-Aztecan substratum meeting corn coming from the south. Corn was passed on and eventually arrived among the northern peoples. In other words, the Sonoran drift occurred before the development of Basketmaker II culture in the Four Corners region. As this Sonoran movement pushed south, it may have lost its Basketmaker aspect due to southern cultural influences as well as to

[6] Putnam, F. W. "Man and the Mastodon," *Science*, Vol. 6, No. 143, pp. 375–376, 1885.

change in environment. The archaeological sites of La Quemada and Chalchihuites in Zacatecas are considered outposts of the sub-Mexican cultures centering in Jalisco or southern Sonora. These regions show Uto-Aztecan participation in Mexican culture well back into Toltec times and possibly before Nahuatl broke away from the Sonoran form of Uto-Aztecan speech. The Sonoran Uto-Aztecan peoples became passive filters through whom isolated traits of Mexican culture were passed to the American Southwest. Again moving southward, the Nahua spearhead of Uto-Aztecan culture entered the Valley of Mexico and took over a Middle American elaboration. Place names indicate that the Toltec were speakers of Nahua, and it seems that they passed through Jalisco and so on down into Central America where their descendants are known as the Pipil and Sigua, etc. By the time the Aztecs had reached the Valley of Mexico, after passing through Jalisco and Michoacan, they had assumed much of Middle American culture and no longer were the nomadic barbarians that the fierce Chichimecs had been before them.

Dr. Zingg has treated in detail only the Uto-Aztecans of the American Southwest and of Sonora, yet the above outline will show the magnitude and scope of the task he has set for himself. He has visualized a most significant line of investigation and has prosecuted the inquiry with a directness of purpose that may well guide other such researches. The points which he has raised and explained have been crying for explanation for a long time, and it is most encouraging that someone has finally attempted to make the facts paint their picture. Dr. Zingg may be included with Mr. Gladwin of whom Dr. Kidder said, " . . . it is certain that his in many respects revolutionary interpretation of what we now know of New World prehistory will do much to advance the study of American archaeology by focusing attention upon a number of fundamental, but of late unduly neglected, problems."

That Dr. Zingg's conclusions cannot be accepted as they now stand is due to no inherent impossibility of the hypothesis itself. The hypothesis may eventually prove to be correct, at least in its broad outline. But at the present, its actuality has not been demonstrated by the data adduced to the problem. This has been due, I believe, to three main causes: a delay in publication; a confusion in terminology which has generated an erroneous temporal assumption; and, finally, to an uncritical and only partial use of the archaeological data available.

Dr. Zingg wrote this monograph no later than 1933, and probably in 1932. This is apparent from his bibliography which includes only one reference published in 1933; all others bear the date of 1932 or earlier. However, since there is no mention of this delay in publication (from 1933 to 1939) and since no allowances for the lapse are requested in the text, it must be assumed that Dr. Zingg regarded his conclusions, written no later than 1933, to be valid as of 1939. A mere listing of a few works published from 1933 to 1939 and bearing upon, if not contradicting, some of his assumptions will serve to emphasize the fact that many of these assumptions are not axiomatic as of 1939: the Mogollon and Snaketown reports, Steward's work on Basin archaeology, Mera's reconstructions of the prehistory of north-central New Mexico, and the publications of the Museum of Northern Arizona.

The assignment of all modern Uto-Aztecan peoples to a descent from a single 'proto-Uto-Aztecan' culture rests on a rigid culture-language association as well as upon a confusion with regard to time. Without going into the validity of the language-culture postulate, but granting it for the present, the conclusions still do not follow. Dr. Zingg says that "The close relation of language and culture is such that if a people once spoke a common language, *at the same time* they shared a common culture" [p. III, italics mine]. He proceeds by saying that "Since Uto-Aztecan languages are genetically related, it is certain that they represent a development from a 'proto-Uto-Aztecan' language which

connotes a 'proto-Uto-Aztecan' culture, underlying the cultural specializations now seen" [p. 2]. Thereupon, through archaeological sequences going back into the past from the Uto-Aztecan Paiute and Hopi, he connects Uto-Aztecan speech with Basketmaker archaeology and derives the cultures of all Uto-Aztecan speakers from a Basketmaker, i.e., proto-Uto-Aztecan, source. Again granting his premise, this derivation might conceivably be correct if it could be demonstrated that proto-Uto-Aztecan speech and the culturally proto-Uto-Aztecan Basketmakers existed "*at the same time.*" But even this possibility is eradicated when he states that the term 'proto-Uto-Aztecan' is "used in a special significance in this paper, not as the first or original Uto-Aztecan culture but as the earliest Uto-Aztecan culture as to which we have data" (p. 15). On what grounds, then, are we to assume that this "earliest Uto-Aztecan culture as to which we have data" was in existence "*at the same time*" as proto-Uto-Aztecan language? It is obvious that Dr. Zingg has been misled by his use of the word 'proto.' 'Proto' has been used in two distinct senses and yet he has reasoned as if the word had but one chronological implication.

With regard to Dr. Zingg's use of his archaeological sources, it may be said that nowhere has he treated the whole of any culture or the total traits from any one site. For such a far-reaching hypothesis as his, it seems that complete analysis is called for and that a selection of data might cause serious warping of the comparative picture. Then, too, misinterpretations of the archaeological data have vitiated some of his points, as when he calls the Kiatuthlanna pithouses "Basketmaker III" [p. 46] and attributes to Basketmaker II the ring-topped baskets identified by Guernsey and Kidder as Pueblo II or III [p. 135]. His discussion of proto-Uto-Aztecan mortars as found in Lovelock Cave is completely invalidated because he has used material described from open sites in the Humboldt Valley [p. 27 et seq.]. Further, his use of percentage figures in the tables of "Traits in Basket-maker 'Proto-Uto-Aztecan' Cultural Substratum" [pp. 113–114] must be rejected. Instead of using traits common to both groups to show the "Percentages of Basket-maker I Culture among N. Paiutes," he has added (with error) the total number of traits listed for each culture and calculated percentages from these figures.

Finally, the basic structure of Dr. Zingg's hypothesis is founded on his identification of Basketmaker I with the proto-Uto-Aztecan cultural substratum. This has been done on the basis of Lovelock Cave material. Making the association of the upper levels in the cave with modern Uto-Aztecan Paiute, he projects this language-culture tie-up into the lower levels which he reasons are proto-Uto-Aztecan culturally. These lower levels he calls Basketmaker I, and, tracing the Basketmaker-Uto-Aztecan association to modern times, through the Paiute and Hopi, he concludes that from such Basketmaker I beginnings came all later Uto-Aztecan culture. Only one of the many assumptions inherent in this hypothesis will be treated here. The crux lies in the identification of Lovelock Cave lower levels with Basketmaker I. Dr. Zingg is not entirely alone in his view that the nonagricultural culture of Lovelock represents pre-agricultural Basketmaker. Nevertheless, such a view will not meet with universal acceptance and certainly cannot be stated as an unequivocal fact requiring no discussion or proof. In fact, it appears possible, and even probable, that the Lovelock material is not Basketmaker I or Basketmaker at all, if by Basketmaker we mean Basketmaker II of the San Juan. The former depicts a littoral, hunting, fishing, and gathering culture quite apart in economy, in the weighting of its techniques of manufacture, and in its artifacts from agricultural Basketmaker. To equate these two economies under a single cultural designation would appear to be misleading, and the disharmony is even greater when the desert gathering cultures of southeast New Mexico and Texas are included. If Dr. Zingg had re-analyzed the available cave material, I feel sure that he would have rejected the current belief that the presence of the atlatl,

coiled basketry, twining technique, curved club, sandals, etc., indicates a cultural identity with San Juan Basketmaker or any other specific group. These few generic similarities of rather wide distribution have overshadowed for many years the detailed and very real differences in cultural materials from cave sites. There has been little or no consideration of total culture-rosters, and no extensive and determined effort has been made to weigh the predominance of various traits within, and between, sites or groups of sites. The major fault lies, however, with the practicing archaeologists who have done the identifying, rather than with Dr. Zingg. It is to his great credit that he assayed an interpretation of such provocative and neglected data. Others who will attempt the program in the future will benefit by his pathfinding.

In his Report on Archaeology of Southern Chihuahua, Dr. Zingg has given us our first extended account of the archaeology of this region. Not since the brief notes published by Lumholtz has there been a report dealing with this area, which, in addition to providing interesting comparative material for other studies of north Mexico prehistory, offers to the investigator the inviting possibility of tying up archaeological sequences with an historic and still functioning culture which itself has been documented.

The report is stated to be a summary and résumé of more detailed notes filed at several libraries in the United States. It deals with excavations and observations in cave sites within modern Tarahumara territory at the headwaters of the Rio Fuerte in the Sierra Madre Occidental. The excavation of one cave and the resultant finds are treated at some length. This site is identified as "Rio Fuerte Basket-maker." There follows a very brief account of finds from another cave which is stated to be culturally Transitional between the "Basket-maker" and the later "Cave Dweller" phases. The Cave Dweller sites, forty-seven in number, provided considerable material which has been handled typologically rather than by site. These sites are referred to as prehistoric and historic Tarahumara. In place of the *Conclusions*, which are, however, itemized and paged in the *Table of Contents*, there is substituted an Appendix by Miss Gene Weltfish on Cave-Dweller Twill-plaited Basketry.

The first site has been identified as Basketmaker on the basis of nine traits or sets of traits: presence of corn and absence of beans, absence of pottery, flexed burial in cists, blankets of rabbit fur and turkey feathers, absence of dwellings or hearths, antler punches and bone awls, string apron, coiled basketry, and circular slab structures [cists]. The Transitional site is identified on the slim basis of "The impression of the grass-mud container in the mud roof . . . " of a cist. There were no other "Basket-maker" traits present and even the cist, except for its roof, is dissimilar to those from the "Basket-maker" site. It would seem best to reserve judgment on the cultural position of the so-called Transitional site. The Cave-Dweller phase is characterized by living and storage structures within caves, by pottery and loom weaving, and by European artifacts and materials such as steel axes and wool. Dr. Zingg makes a case for the identification of the Cave-Dweller phase with the prehistoric and historic Tarahumara.

As with the *Reconstruction*, this paper makes the debatable assumption that a certain number of traits are indicative of Basketmaker culture as typified in the Four Corners region of the American Southwest. The work also suffers from its obvious summary nature and a lack of descriptive detail and general precision. Its value for detailed comparative purposes is neither claimed nor achieved. But as a résumé, it is a very suggestive and important contribution.

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Archeological and Geological Investigations in the San Jon District, Eastern New Mexico. FRANK H. H. ROBERTS, JR. Smithsonian Miscellaneous Collections, Vol. 103, No. 4. 1942.

For many years archaeologists concerned with the problem of Yuma points might well have been compared with an individual who held a number of pieces from a jig-saw puzzle but lacked the interlocking pieces which would establish the position of the parts already obtained. Some of the pieces might be sufficiently similar to indicate that they would eventually fit into a certain limited section, but the closeness of the relationship could not be established. Sometimes there was even the grim possibility that a certain piece might belong to another puzzle.

Although Frank Roberts' recent publication does not by any means provide all the missing parts in the Yuma puzzle, it makes very definite contributions which should do much to help in establishing the proper position of some of those already obtained. Also, it provides interesting information as regards other forms, possibly only slightly younger than the Yuma, and more recent complexes.

Excavations were carried on during 1941 on the north rim of the Staked Plains south of the Canadian River near the town of San Jon, New Mexico. Actual superposition of artifacts which has been so sorely needed is still lacking but four stratigraphic horizons were established which, on the basis of geological studies, can apparently be placed in proper sequence.

In the earliest is found a thick, roughly flaked, square based, parallel sided type of point which has most of the characteristics attributed to the Indeterminate Yuma. The consensus of the conference held at the Laboratory of Anthropology in Santa Fe in 1941 was that the Indeterminate group should be dropped from the Yuma class and that names should be assigned only when more information was available as to the place of origin and relationships of the forms included. Roberts has followed the practice advocated at this conference and has tentatively given the name of San Jon point to the type found in the earliest horizon at the San Jon site.

The reviewer, although responsible for the introduction of the Indeterminate Yuma classification, holds no brief for its perpetuation. At the time when all projectile points which did not either fall into the Folsom category or have the characteristics of more modern forms were being indiscriminately classified as Yumas it seemed desirable to point out certain marked typological differences and make some provision for differentiating between the different types all referred to as Yumas. The division of the so-called Yumas into Oblique, Collateral, and Indeterminate classes seems to have served a useful purpose although it was almost certain that the latter group was far from homogeneous. Now, however, as more information becomes available it seems a very sensible solution to return to the accepted practice of naming artifacts or complexes after the type station. Prior to this time a distressing lack of type stations has made such a course of action impossible. The Santa Fe Conference also recommended the use of the term Eden Valley Yuma in place of Collateral Yuma.

Associated with the San Jon point were the completely fossilized bones of a large bison, possibly *taylori*. This horizon has not been dated geologically but at another part of the site a Folsom fragment was found weathering out of the same layer together with similarly fossilized bones. Mammoth remains, though not found with the artifacts, occur nearby in the same stratum.

Geologic evidence indicates that between the period of this horizon and of the next there occurred a period of erosion followed by considerable deposition which suggests a considerable difference in age between artifacts from the two horizons. Points from the second horizon are of the Eden Valley Yuma or Collateral type. Associated with them

were the partially fossilized bones of an essentially modern species of bison. Even should the horizon of the San Jon point prove to be more recent than is now believed, there is undoubtedly a broad time lapse between it and the horizon of the Eden Valley Yuma.

In essentially the same deposits as the latter, but in a somewhat higher level, occur long leaf-shaped blades with rounding shoulders, straight tangs slightly beveled to the left, and concave bases. This type resembles forms previously found in the Texas area to the east but there are sufficient differences to make it impossible to correlate them for the present. Unfossilized bones of modern bison are associated with them. Roberts considers these points "somewhat, although not markedly, later than the Yuma."

Apparently contemporaneous with this group, but possibly somewhat older, is another type found in the lower plain in a buried occupation level. It resembles points from the Edwards Plateau and some from the Big Bend region of Texas, but there are sufficient differences to warrant placing it in a separate class. The tip is sharply tapered, the sides roughly parallel, and the base flat. It is rather broad relative to its length.

The most recent series of points from the basin includes small notched and tanged forms associated with late sites in many sections of the country.

In the earliest horizon, with the San Jon point, and in the Yuma horizon, no implements were found associated, other than flakes which may or may not have been utilized. Various kinds of scrapers, blades, choppers, and grinding stones were found in the third and fourth horizons. The fourth horizon also yielded a few potsherds including Panhandle wares and Chupadero Black-on-White, a Pueblo ware. Roberts places the probable period of this horizon as the late fourteenth or early fifteenth century. A cache of forty-four stone implements, including five large blades, and a fire pit were found in a gully bank some miles west of the main site. They probably belong to the historic period or barely antedate it.

Although definitive answers are still lacking for innumerable pressing questions concerning Yuma artifacts this report does much to throw greatly needed light on important aspects of the problem. It is of course regrettable that there was no actual superposition of specimens but there seems to be good reason to believe that the postulated sequence of horizons is essentially correct. Of most significance is the geological evidence which indicates that a long period of time separated the horizon of the San Jon point and that of the Eden Valley Yuma. This is further confirmed by the difference in degree of fossilization of bones found in these deposits as well as the replacing of one type of bison by another. Also of interest was the finding of points reminiscent of previously described Texas forms which do not appear to be very much younger than the Yuma. There appears to be no break in the occupation of the area from the period of the Yuma to late protohistoric times.

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